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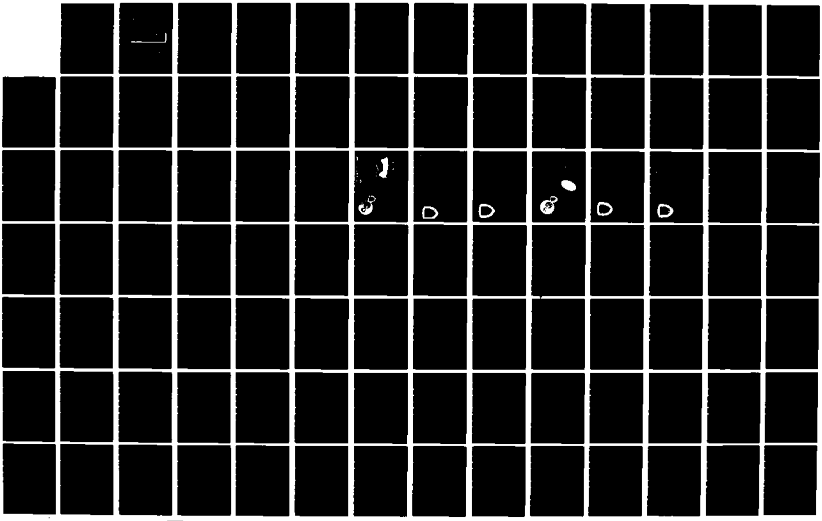

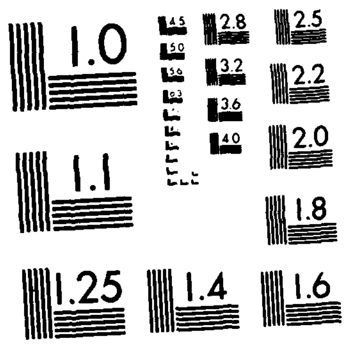

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SORTIE DURATION AND HELICOPTER COMPONENT FAILURES (AN EMPIRICAL STUDY)

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This study investigates the effect that sorties, flying hours, and usage have on component failures for Army aircraft. The report documents the work done. It includes many graphs in the appendix depicting 20 years of 1352 flying hour data which may be useful in other research work. It shows no relationship between failures and flying hours, sorties, or utilization.

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SUMMARY

1. Background

The purpose of this study was to investigate the effects that sorties* have on component failures for Army aircraft. The underlying hypothesis was that the stresses occurring during take off and/or landing cause more failures of aircraft components than does continuous flying. Under this hypothesis an increase in the number of sorties for a given flying hour program results in an increase in demand for spare parts. The Army's current method of forecasting demand is based solely on flying hours and past experience and thus is inconsistent with this hypothesis.

The scope of the study was limited to appraising the implications of the hypothesis as applied to forecasting demands for repair parts at the wholesale level. The referenced studies done on fixed wing jet aircraft gave various models to be evaluated while analyzing the data. These studies suggested other variables; some of these were also considered in this work.

2. Findings

The analysis was done primarily on aggregate information. The direction of the study was dictated by the availability of data and many of the suggested models developed by others could not be directly tested. By looking at worldwide (peacetime) and Vietnam (wartime) data, it was apparent that sorties for Army aircraft were quite a bit shorter in duration** and less variable in absolute terms for both peacetime and wartime than those observed in earlier work done on fixed wing-jet aircraft. This short duration of sorties made it impossible to detect any failure time pattern (i.e. time to fail within a sortie).

Analysis of about 20 years of flying hour records (DA Form 1352) for five types of aircraft showed a consistently high correlation between sorties and flying hours. This finding was corroborated using three months of Sample Data Collection (SDC) data on Blackhawk helicopters collected during the Bright Star Exercise.

Comparison of peacetime and wartime data (1352 records) showed both a higher utilization rate (flying hours ÷ hours available) and longer duration sorties for the wartime environment. Based on the referenced studies for fixed wing aircraft, both of these factors may cause lower failure rates per flying hour for wartime planning when one ignores combat produced damage.

* Sortie is defined as a flight determined by a takeoff and a corresponding landing.

** Sortie length or duration is defined as the flying time between the takeoff and landing.

Since little actual failure data could be obtained, several indirect methods were used to try to find the relationship between failures and sorties and between failures and flying hours. The 1352 records contain aircraft availability and other related data. The Bright Star data contain maintenance events and man-hours. Regressions of these variables against sorties and flying hours resulted in low correlations. The IRO wholesale demand data did show increased demands for increases in flying hours, but the causes of the increase in demands were confounded with wartime effects. Several other IRO studies indicated that the use of flying hour data improved the forecast for individual item demand at the wholesale level.

3. Conclusions

This study was not able to show any relationship between failures and flying hours, sorties, or utilization. The data were limited in that other causal effects could not be removed from the analysis, nor could the explanatory variables be controlled adequately to statistically quantify the study's findings. Other IRO studies did demonstrate the favorable use of flying hours in making demand forecasts and the lack of results of this study should not be construed as negating these findings. This report was written to document the work done even though there were no positive conclusions. It includes many graphs in the appendix depicting 20 years of 1352 data which may be useful in other research work.

CHAPTER I

INTRODUCTION

1.1 Background

The Army currently invests several hundreds of millions of dollars in safety level stock at the wholesale level to guard against the errors made when forecasting demand for repair parts in the supply system. In an effort to impact this investment, the Army Inventory Research Office (IRO) has conducted several research studies [4], [8], [11] with the intent of improving the forecast method used in the wholesale management inventory system known as the Commodity Command Standard System (CCSS).

These studies considered various demand models and forecast schemes and used the IRO demand data base for empirical investigation and evaluation. The IRO data base [6] includes 15 years of requisitions and demand for aviation parts by quarter accumulated from the Troop Support and Aviation Readiness Command (TSARCOM) Demand Return and Disposal (DRD) files from 1967 thru 1982. Actual flying hour history is also included in this data base.

In each study, program dependent forecast methods performed best (see [10] for evaluation methods) when evaluated using a simulated supply system. The program variable, flying hours, was applied to the data in a "straight line" fashion, i.e. a forecast for demand per flying hour was made, then this forecast was multiplied by the number of flying hours scheduled for the forecast horizon to determine the forecasted demand. This straight line method is what is currently being used in CCSS. Similarly the straight line assumption is being considered by the wartime planners, i.e. if we double flying hours during war, we will also double requirements for repair parts.

Maurice Shurman of the Boeing Corporation has shown [14], [15], using data from fixed wing, jet aircraft that this straight line assumption may be incorrect and that the effect of takeoffs should be considered. He claims that a large portion of the failures occur early in a flight and that these failures are caused by the stress of takeoff. Hence a unit flying short sorties (flying time between takeoffs) over a fixed flying hour program will generate more failures than a similar unit flying longer sorties for the same program.

Others, [1], [3], [13] have followed Shurman's lead and have supported his finding that the straight line assumption is incorrect. These studies

were all performed on fixed wing aircraft and may not apply to helicopters the way they are employed by the Army. Details of these findings will be cited in the next chapter.

1.2 Problem

It is felt that if Shurman's findings are applicable to Army aircraft (primarily helicopters) a sortie dependent model can be formulated and an improved demand forecast algorithm developed.

1.3 Objectives

The following is a list of objectives which describe the anticipated course of the study.

a. Determine if data are available to measure the variability of sortie lengths. Flying hours per sortie is a major consideration of the study and should vary enough between time frames, aircraft, etc., to make the variable meaningful at the wholesale (aggregated) level of demand. Wartime vs peacetime scenarios should be considered.

b. Determine if failure or demand data are available to relate failures to sortie length. Time to failure within a sortie would be the principal data element but other data types may be considered. Aggregate data may be used and experimental design layouts may be useful.

c. Analyze the data and determine the relationship between failures and sorties. Consider the findings from cited reports in developing the relationship.

d. Develop a forecast algorithm capturing the sortie/flying hour relationship.

e. Add sortie length and/or the number of sorties flown to the IRO demand history file.

f. Test the sortie dependent forecast model using the IRO demand history file comparing it with the current forecast method.

g. Determine the feasibility of extending the results to other weapon systems.

1.4 Methodology

The methodology follows the list of objectives. First an intense literature review was done including site visits and telephone calls to a few of the referenced authors. Some of their findings are summarized in the next

chapter. Next several discussions were held with TSARCOM and with the Reliability, Availability and Maintainability Division of AMSAA to identify availability of data.

At the outset it was apparent that helicopter sorties were quite a bit shorter in duration than those flown by fixed wing Army aircraft. To get a better feel for the magnitude and variability of helicopter sorties a request was made to TSARCOM to derive quarterly statistics on five aircraft (OV-1, AH-1, CH-47, UH-1, OH-58) from the 1352 flying hour report. A description and analysis of the data are found in Chapter III. Since this was the first time a historical survey was made of the 1352 data, all the time series graphs made from the data are included in Appendix C. This data represents actual field usage information as opposed to developmental data which is commonly used for reliability estimation.

The 1352 analysis showed that, in the aggregate, sorties were highly correlated with flying hours. The direction of the study was then shifted to determine a failure rate/flying hour relationship. Chapter III describes the attempts at relating 1352 reliability/availability statistics to flying hours.

A continuation of the failure rate analysis is given in Chapter IV where Sample Data Collection data and demand data were considered. Alternative causal variables are also discussed in this chapter. The conclusions and recommendations are found in Chapter V.

CHAPTER II

RELATED STUDIES

2.1 Inventory Research Office

The Army as well as the other Services have in the past assumed a direct proportional relationship between component failures for aircraft and flying hours. This relationship has been indirectly tested by IRO in several previously mentioned studies by comparing forecast algorithms with and without program (flying hour) adjustments using actual demand and flying hour history. In each case the program dependent algorithm worked best. Additional attempts at IRO to statistically compare flying hours with demands using regression techniques have not been very successful due to a problem of relating demands to specific usage and aircraft.

2.2 Boeing

Maurice Shurman of the Boeing Corporation [13-15] studied failure data on various fixed wing jet aircraft. His initial work included time to failure analysis on six aircraft (F-106, E-3A, B-52, F-4, C-141, 707) where he noted that a high percentage of the failures occurred early in the flight or sortie. By plotting these data with a common format relating percent of total failures per sortie against time to fail as a percent of the nominal sortie length for each system he generated a family of curves whose bounds were similar to those shown in Figure 1.

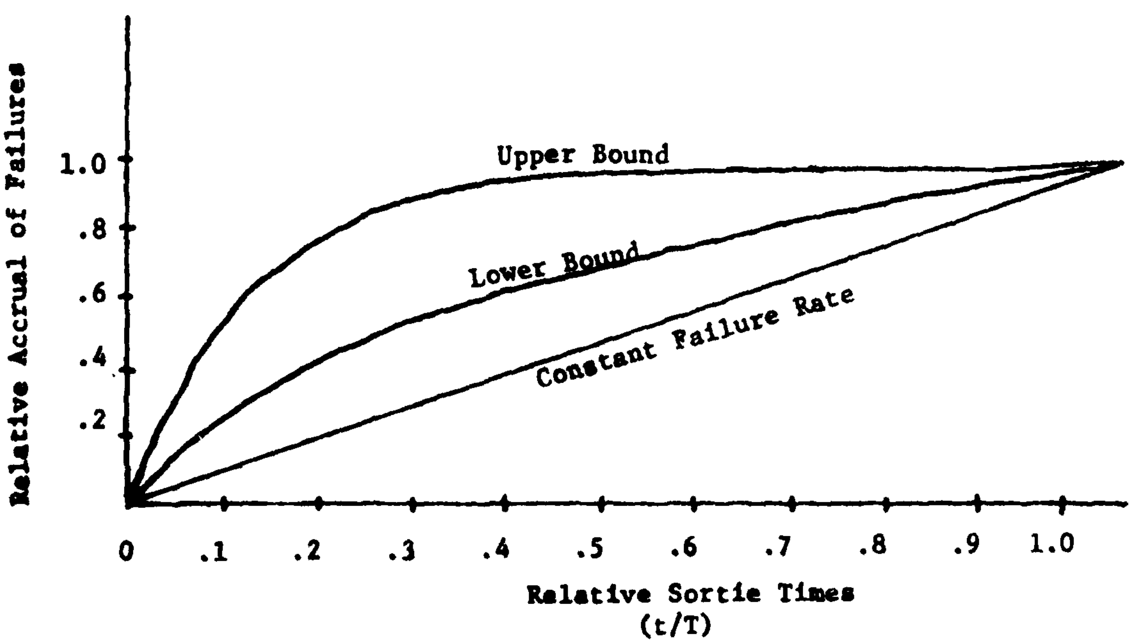

Figure 1. Common Plot

Using these curves he generated reliability equations. He confirmed his findings with other jet aircraft including the C5-A, C141-A.

His results indicate that sortie length should be considered when developing failure estimates, i.e., an increase in sorties per flying hour would result in an increase in failures per flying hour. This conjecture if true for Army helicopters would impact many areas such as contingency planning, reliability estimates and demand forecasting.

2.3 Air Force

COL Chris Shaw of the Air Force [13], in his analysis of C-5, C-130, C-141, and P-3C aircraft, claims that both sorties and flying hours affect failures. His model combines the failures due to start up, landing, and steady state flight in the following linear manner:

$$Y = A + B\ (X-1) + C$$

where

Y = failures per sortie

A = failures due to start up of the sortie

B = steady state failure rate during cruise (failures per flying hour)

C = failures due to landing of the sortie

X = sortie length in hours

He confirmed his model by plotting and regressing average failures per sortie against sortie length. He deleted short sorties (less than one hour) from the regression and made a point estimate of these observations. His data did show a non zero intercept indicating the sortie effect. Figure 2 compares Shaw's finding with Shurman's.

2.4 Institute for Defense Analyses

P. B. Buck of the Institute for Defense Analyses [1] has compared maintenance man-hours to utilization rates for the 6th and 7th fleets for the A-6E, A-7E, F-4J, and F-14 aircraft. He used multiple regression analysis which included the explanatory variables: utilization, flying hours, sorties, and dummy variables indicating different groups. His preliminary findings indicate that utilization rate (hours flown/hours available) has a much greater impact on failures than do sorties. This relationship is hyperbolic in function with failures per flying hour decreasing with an increase in flying hours per month for the aircraft. Hence the assumption of a constant failure rate (failures per flying hour) is incorrect

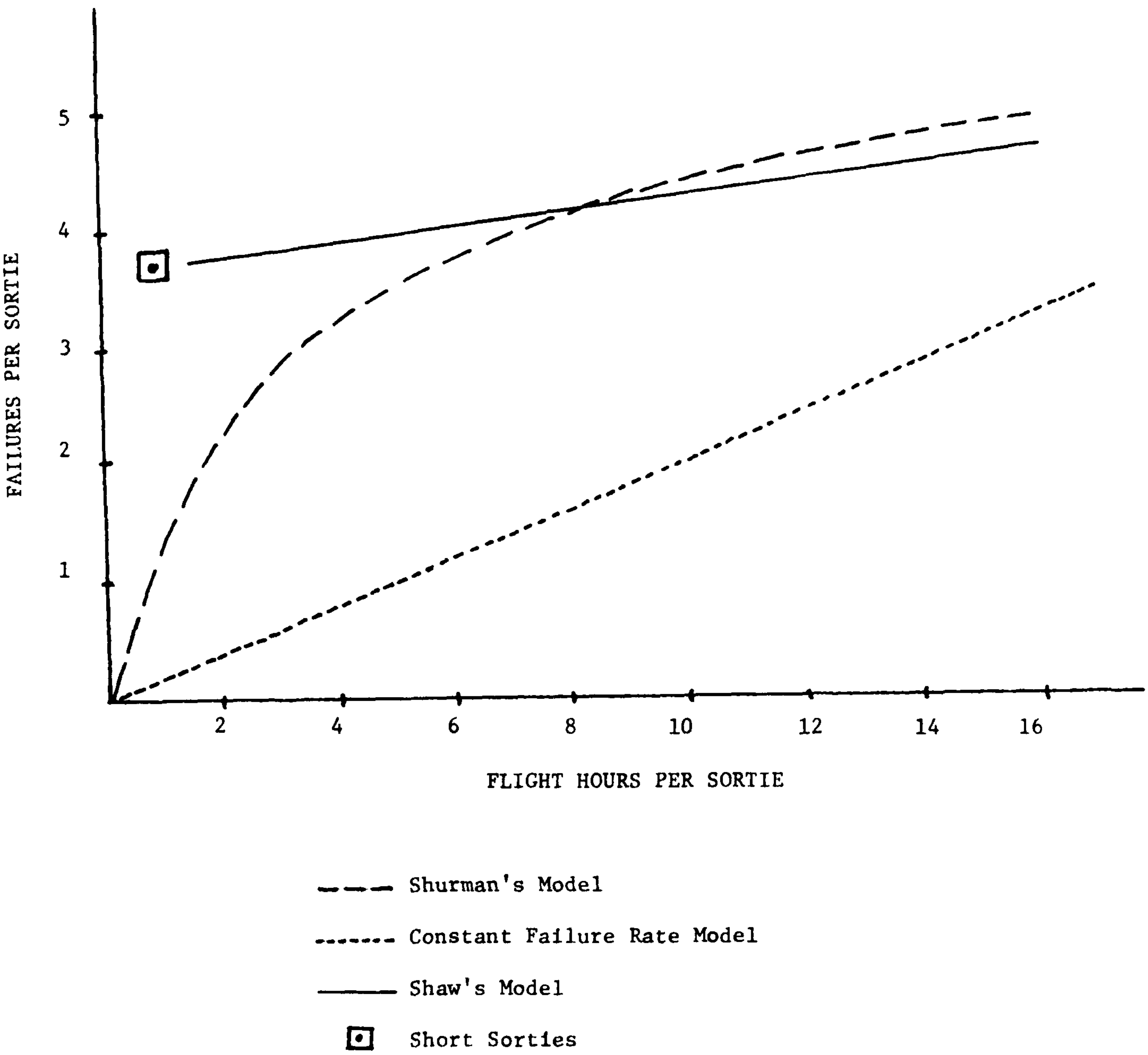

Figure 2. Comparison of Failure Models

and should be adjusted to reflect the utilization of the aircraft. This implies that a small peacetime utilization would generate a larger failure rate estimate (failures per flying hour) than would be expected during wartime where the utilization would be greater.

2.5 Others

Linda Cavalluzzo of the Center for Naval Analyses [3] has demonstrated in her preliminary work using F14-A data that the number of sorties and the number of flying hours flown in given periods were highly correlated. She developed a linear relationship between failures and flying hours using an econometric method (two stage least square). (This method eliminates the secondary dependency that failures have on flying hours.) Her equations show a more severe slope on flying hour (approximately 1) than did the normal least squares estimate.

H. Campbell of the Rand Corporation [2] considered seven other operational variables and concluded that only flying hours should be used to explain demand variation.

T. S. Donaldson and A. F. Sweetland of the Rand Corporation [5] studied the relationship between maintenance manhours and aircraft flying hours. Their findings were mixed across the various systems studied and the analysis was confounded by mission type variables.

G. Walker, D. Wilson, and D. Hindes [19] of the Boeing Corporation did an extensive study for the Air Force Human Resources Laboratory where they estimated the maintenance impacts of various characteristic parameters of the design, operational, and natural environments of the subsystems of various aircraft. Separate models were developed using multiple regression techniques for 29 equipment types. Thirteen of these models included a sortie variable.

Martin Cohen in [4] cites other references, all who have had various degrees of success in relating failures to operational variables.

2.6 Model Consideration

The work done by Shurman, Shaw, Buck, and IRO had the major impact on the conduct of the study. Each model was indirectly considered and each explanatory variable was investigated. The mode of evaluation was dictated by the availability of the data and the conclusions were somewhat subjective using data analysis inferences.

CHAPTER III

SORTIE VARIABILITY

3.1 Basic Questions

Since the referenced studies relating sorties to failures were all done using fixed wing aircraft data, a preliminary analysis was done to investigate the statistical characteristics of sorties as applied to helicopters and other Army aircraft. The basic questions of concern were as follows:

a. How long are typical sorties for helicopters as compared to fixed wing aircraft?

b. Does sortie length vary between aircraft, time, units, and scenario?

c. Is sorties variation sufficiently large to consider it as an explanatory variable?

d. Is there a difference between wartime and peacetime sortie lengths?

e. Are sorties correlated with flying hours?

f. Is utilization (flying hours flown/hours available) correlated with flying hours and/or sorties?

g. Is reliability or maintainability affected by sorties?

3.2 Data Description

To help answer these basic data questions, TSARCOM went into their archives and retrieved "1352 - Army Aircraft Inventory Status and Flying Time" records from the early 1960s to 1982 for five systems: AH-1, CH-47, OH-58, OV-1, UH-1. (Three years of UH-60 Blackhawk data were also collected.) These data are collected routinely on a monthly basis for each tail number by unit at organization level. The data contain flying hour and sortie information as well as maintenance and availability statistics. Appendix A contains sketches of these aircraft.

Since the study deals mainly with failures (demands) as seen at the wholesale level, the data were collected in terms of quarterly aggregate statistics which are described in the next section. During the war years, the data were separated into Vietnam and Non-Vietnam (worldwide) categories.

3.3 Data Variables

To determine a profile of usage for each system, 16 variables or statistics were computed for each quarter of available data. These statistics give the number of system and units fielded, the gross number of flying hours and sorties,

the average and standard deviation of usage (utilization) per aircraft (tail number), the average and standard deviation of sortie length, and attempts at reliability and availability measurements. The definition of each variable is found in Appendix B.

3.4 Time Series Analysis

The initial analysis consisted of time series plots of each variable with Vietnam data superimposed on the world wide (excluding Vietnam) series. These graphs are found in Appendix C and will be referred to as "time series plots" throughout this report. Averages and standard deviations of the plotted (non-zero) quarters are included for both Vietnam and worldwide data.

The following is a list of observations gleaned from the time series statistics:

a. The average and coefficient of variation of the two sortie length variables (average duration of sorties, average duration of sorties by aircraft - refer to Appendix B for definition) over the time series are given in Table 1.

TABLE 1. SORTIE DURATION (HRS)

		AH-1		CH-42		OH-58		OV-1		UH-1	
		AVG	COEF-V	AVG	COEF-V	AVG	COEF-V	AVG	COEF-V	AVG	COEF-V
AVERAGE DURATION OF SORTIES	WORLDWIDE	.33	.20	.30	.19	.33	.16	.86	.14	.32	.16
	VIETNAM	.57	.23	.34	.12	.38	.28	1.66	.15	.34	.12
AVERAGE DURATION OF SORTIES BY AIRCRAFT	WORLDWIDE	.30	.35	.31	.19	.37	.76	.79	.21	.34	.20
	VIETNAM	.56	.32	.34	.30	.39	.32	1.56	.20	.38	.15

From these data we see that the sortie durations are quite a bit shorter for the Army aircraft than those experienced for the fixed wing/jet aircraft cited in the referenced studies. The coefficient of variation (ratio of standard deviation to average) is approximately .20 between the quarterly averages which give a range of $\pm$ 60 percent (3 Std. Dev.) of the reported average of averages. Thus for a typical average sortie length average of .30 hours, the actual quarterly average may range from .12 to .48 hours. For a given 1000 flying hour program, the actual range of the number of sorties per 1000 hours may be between 2083 and 5555 and may

have significant impact on the number of failures per flying hour. This table also points out that the average sortie during Vietnam was longer for each aircraft than that experienced on the Non-Vietnam worldwide average and quite a bit larger for the AH-1 and OV-1.

b. Table 2 compares the average quarterly (averaged over all non-zero quarters) flying hour program for each type of aircraft. These data are non stationary and follow trend lines and hence maximum values will be given with each average as opposed to standard deviations. Minimums are not given since they are quite low and indicate the initial build up of density.

TABLE 2. FLYING HOURS (PER 3 MONTHS)

	AH-1		CH-47		OH-58		OV-1		UH-1	
	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX
WORLDWIDE	13,908	35,000	10,517	16,000	60,913	120,000	5,706	7,000	166,923	250,000
VIETNAM	46,686	90,000	31,661	60,000	21,943	45,000	10,301	20,000	298,648	500,000

Except for the OH-58, the hours flown in Vietnam are two to three times greater than those flown during worldwide non Vietnam wartime missions. Thus if the straight line assumption about failures and flying hours is correct, then we will need two to three times more spare parts to support a conflict similar to Vietnam than to support peacetime activities. Note also the maximum Vietnam flying hours were on the magnitude of from four to six times the peacetime average.

c. The flying hour program reflects to some extent the density of items fielded. The density comparisons are shown in Table 3. Again maximum values are given instead of standard deviations.

TABLE 3. DENSITY

	AH-1		CH-47		OH-58		OV-1		UH-1	
	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX
WORLDWIDE	569	1100	296	500	1569	2300	151	230	2668	4800
VIETNAM	317	560	227	325	159	300	63	100	1539	2500

The averages are somewhat misleading due to the density buildup over time. The comparison of maximums can be used to determine how much of the total density was fielded in Vietnam during its peak period. (Note World maximum occurred after the Vietnam war and reflects total density of equipment.) Hence for the AH-1, CH-47,

OV-1, and UH-1 approximately 50 percent of the total density was deployed in Vietnam at the peak but these aircraft flew three to six times the normal peacetime flying hour program. (Note:worldwide does not include Vietnam during the war years.)

d. Usage or utilization rate combines the flying hour program with density. It compares by tail numbers the total hours reported on the unit's property book with the number of hours flown (ratio) during the same period. Thus from the last two remarks it is not surprising to see that the Vietnam utilization is much greater than peacetime. Table 4 shows these differences.

TABLE 4. UTILIZATION - USAGE

	AH-1		CH-47		OH-58		OV-1		OH-1	
	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX	AVG	MAX
WORLDWIDE	.01	.02	.02	.03	.02	.07	.02	.03	.03	.05
VIETNAM	.07	.10	.06	.09	.07	.08	.07	.10	.09	.11

The peacetime utilization is relatively constant at about 2 percent but the Vietnam data reflected a build up from 6 percent to about 10 percent. If Buck's findings are true for Army aircraft then the failures per flying hour rate for Vietnam (excluding combat damage) should be much smaller than those experienced during peacetime. Unfortunately we don't have data to test this hypothesis.

e. Even though our main interest in the study dealt with aggregate variability we also measured the variability between aircraft (tail numbers) by computing standard deviations within each quarter for a few of the variables. The time series of these standard deviations are found in Appendix C. Table 5a relates the average standard deviation to the estimated overall mean by giving the coefficient of variation for each system for usage and sortie duration.

TABLE 5a

AVERAGE COEFFICIENT OF VARIATION OF USAGE

	AH-1	CH-47	OH-58	OV-1	UH-1
WORLDWIDE	2.00	1.00	1.00	1.00	1.00
VIETNAM	.60	.70	1.60	.60	.55

AVERAGE COEFFICIENT OF VARIATION OF SORTIE DURATION

	AH-1	CH-47	OH-58	OV-1	UH-1
WORLDWIDE	1.20	.93	1.00	.90	1.0
VIETNAM	.67	1.1	.60	.50	.76

These high coefficients of variation indicate that the individual helicopter's experience may be quite different from that reported by the quarterly averages. Presently the variability within the aggregate is not considered when forecasting wholesale demands. If this variability as shown in the table is attributed to causal differences such as unit, mission, geography, then forecasting separately for homogeneous subgroups may be worth considering.

3.5 Regression Analysis

The analysis of the time series data indicated that utilization, flying hours, and sortie lengths exhibit enough variation to be considered as explanatory variables when predicting failures. Since these variables are associated with each other, regression analysis (ordinary least squares) was performed to determine if these variables are sufficiently pairwise independent to be considered simultaneously in a failure rate model. The author considers for this study variables with correlation coefficients of greater than .85 to be statistically the same (i.e. each variable contains the same information). The regressions considered are as follows:

Total Sorties vs Total Flying Hours
Total Flying Hours vs Density
Average Use vs Total Flying Hours

The scatter diagrams of these data are found in Appendix D and E. Table 5.b. contains the estimated correlation coefficients. It should be noted that all lines were fitted with an assumed zero intercept.

TABLE 5.b. ESTIMATED CORRELATION COEFFICIENTS

		AH-1	CH-47	OH-58	OV-1	UH-1
SORTIES VS	WORLDWIDE	.92	.86	.98	.86	.86
FLYING HRS	VIETNAM	.97	.97	.99	.98	.98
FLYING HRS VS	WORLDWIDE	.87	.65	.82	.38	.61
DENSITY	VIETNAM	.96	.95	.97	.95	.98
USAGE	WORLDWIDE	-.43	-.05	-.09	.61	.06
FLYING HRS	VIETNAM	.94	.91	.73	.56	.93

The following is a list of inferences drawn from the analysis.

a. The total number of sorties flown is highly correlated with total hours flown for the data sets considered. The estimated slopes of the regression lines are given in Table 6.

TABLE 6. SLOPE ESTIMATES SORTIES VS FLYING HOURS

	AH-1	CH-47	OH-58	OV-1	UH-1
WORLDWIDE	2.9	3.2	2.9	1.2	3.1
VIETNAM	1.6	3.0	2.8	.57	3.0

This table is consistent with Table 1 where the average sortie lengths were compared. (Note: Total Sorties = Slope x Total Flying Hours
Avg Sortie Length = 1 ÷ Slope)

Longer duration sorties are flown during wartime conditions particularly for the AH-1 and OV-1. Within each class sorties and flying hours are the same predictor variables due to the high correlations but the effects of flying hours on failures may be different between the data classes because of the various slopes found between the classes. Shurman's model would project different failure rates (per flying hour) for those cells with different slopes.

b. Density is currently being used as a program factor in forecasting failures for other than aircraft systems. Appendix D shows a high correlation within each data class between total flying hours and density. The estimated slopes of the regression lines are given in Table 7.

TABLE 7. SLOPE ESTIMATES FLYING HOURS VS DENSITY

	AH-1	CH-47	OH-58	OV-1	UH-1
WORLDWIDE	23	30	37	32	51
VIETNAM	156	140	143	150	182

There are extreme differences between the slopes for worldwide and Vietnam data. For the AH-1 we would expect to fly seven times the number of peacetime hours for the same density. Hence if the straight time flying hour model is correct, but density were used instead of flying hours to forecast demand, the wartime estimate would be too low.

c. Utilization did not correlate well with flying hours using worldwide data; the plot was nearly horizontal. The Vietnam data did show a higher correlation which probably reflects the different intensities of the war. Table 4 from the previous section shows the differences in utilization between the data cells. Utilization as a variable may capture the effect of a wartime scenario and should be considered in the failure rate model.

In an attempt to get a picture of failures from the 1352 data, quarterly availability and reliability variables as defined in Appendix B were computed from the maintenance and supply down times. The reliability (inherent availability) variable measures the percentage of time each aircraft would have been available if only maintenance time was considered when computing down time. Similarly the availability variable measures the percentage of time each aircraft was actually available with both maintenance and supply down time being considered.

These failure related measures were regressed against total flying hours, sortie length and usage. The scattergrams and statistics are included in Appendix E. The OV-1 was the only fixed wing aircraft in the analysis and was also the only aircraft with a consistent (but relatively low) positive correlation between the failure measures and both usage and sortie length. Hence it is questionable whether the findings from the fixed wing aircraft studies are applicable to helicopters.

Additional regression analysis was done between sortie length* vs flying hours, sortie length vs usage, and usage vs flying hours. These statistics are found in Appendix F. In each case the correlations were low for all the data sets implying the pair wise independence between these variables.

3.6 Findings

Within each data subset of the 1352 analysis (system and scenario) the number of sorties flown was highly correlated with the total flying hours (statistically this implies the two variables contain the same information). The estimated slopes which reflect sortie length did differ between a few of the data cells and this difference should be considered in the model building as a cell effect.

The other variables, sortie length and usage, were shown to be individually uncorrelated with flying hours and with each other. These variables could be included in the model without causing any multi collinearity problems. (Note sortie length and cell effect are related and including both may cause problems with the model structure).

Failures in terms of reliability and availability as defined in this study did not correlate well with the explanatory variables, and this lack of correlation raises questions about the credibility of a failure rate model.

Additional failure rate analysis is given in the next chapter.

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*Sortie length should not be confused with the number of sorties which was evaluated in Section 3.4.

CHAPTER IV

FAILURE RATE ANALYSIS

4.1 Introduction

Since the model would be used at the wholesale level, aggregate failures were of main concern. The 1352 data files contain maintenance down time but this included scheduled maintenance which is done on a flying hour basis and would confound any analysis done with it. Other aggregate data sources were not found.

Another source of data was Sample Data Collection (SDC). This might be considered micro data in that it gives historical information on a few selected aircraft from particular units. The data contain only unscheduled maintenance along with monthly flying hours and sorties. It does not contain the aggregate dimension of variability that would be needed for an experimental design analysis. An analysis of SDC, Blackhawk, data is given in Section 2 of this chapter.

An indirect way of measuring aggregate failures is to look at the demands for repair parts at the wholesale level. The IRO has a history of this wholesale data for Army aircraft. The data were of limited use because of the problems encountered when trying to relate the demands to specific aircraft types. Further discussion and analysis of this data is given in Section 3.

In discussing this project with aircraft engineers, maintenance personnel, and data collectors, it was of consistent opinion that sorties do have some effect on failures. They also mentioned many other causal variables that they felt may have a greater impact. A synopsis of these discussions is given in Section 4.

Section 5 contains a subjective summary of the failure rate analysis.

4.2 Sample Data Collection

In an effort to determine if SDC data as "Micro data" could contribute to the "macro analysis," data collected during the Bright Star Exercise were analyzed. The data consisted of monthly non-scheduled maintenance events, maintenance hours, flying hours and sorties for each of fourteen Blackhawk helicopters for three months yielding approximately 42 observations. The analysis was similar to the regression experiments done with the 1352 data.

The scattergram of the number of sorties against flying hours is found in Appendix G. The correlation was high and the slope of 3.7 was of the same gross

magnitude as the slopes observed (worldwide - peacetime) with the 1352 data. Appendix G also contains scattergrams made in an attempt to relate failures to sorties or flying hours. The variables considered were: events per flying hour, number of maintenance events, and total maintenance hours. In each case the correlation of the variable with sorties and flying hours was extremely low. This analysis does not support the failure rate/flying hour - sortie model.

Additional work was done with quarterly SDC data taken from the summary reports. The analysis not presented here gave additional evidence that sorties are correlated with flying hours with a slope of approximately 1/3. Again there was no evidence to support the failure rate vs flying hour or sortie model.

4.3 IRO Demand Data

Since the results of the study are to be applied to demand forecasting, the most natural data base for the failure rate analysis is the IRO TSARCOM demand data file. As mentioned in Chapter 1, these data have been used in previous forecasting studies where the results indicated the favorable use of flying hours when predicting demand for replacement parts.

The file consists of quarterly demands for approximately 22,000 items from the years 1967 to 1982. Martin Cohen [4] describes the first use of the data base and gives a subjective analysis of the relationship between flying hours and demands. In [6], Sally Frazza gives a comprehensive description of the data along with the processing decisions that had to be made in creating the data file.

There are several problems with the data that precludes its use for model building. The 1352 data indicated that the biggest difference in sortie length occurred between the wartime and peacetime periods. The demand file also shows a substantial difference in demands but these demands are for both combat damage and failures hence confounding the analysis. Another consideration is that the data contain many "common items," i.e. items that are common to several systems. Identification of demand to a particular system is not given in the data base. In Cohen's study he picked selected items unique to particular systems and with these groups of items showed a definite relationship between demands and flying hours.

Figure 3 shows a time series of aggregate demand for 12,148 actually demanded items from the years 1967 to 1977. This compares the magnitude of demands between the peacetime and wartime periods. Since the demands during war were three to four times that during peacetime, these data do not conflict with the failure rate model but further detailed analysis and model building is not possible due to the previously mentioned constraints of the data. Thus the best we can say is that the demand data file is consistent with the flying hour/ sortie models but does not support rigorous model testing experiments.

4.4 Other Variables

In discussing this project with Army helicopter experts (engineers, pilots, maintenance experts, data collectors) it became quite apparent that other variables would have to be considered when evaluating the effects of sorties and flying hours on failures.

First off, the notion of sortie would have to be qualified by the types of takeoffs and landings. Takeoffs may be classified in the following ways:

a. Vertical and angular (to various degrees).

b. Full power and constrained power.

c. Maximum payload and minimum payload (crew and fuel).

d. Cold startup and continuation of mission.

Similarly landings may be classified as:

a. Autorotations (emergency landings with the engines stalled - these are practiced as part of the training program).

b. Hovering (where the aircraft doesn't quite touch the ground but stays in one location for loading or unloading).

c. Running (where the aircraft comes in from less than vertical descent).

Flying hours would also have to be classified according to the types of mission as follows:

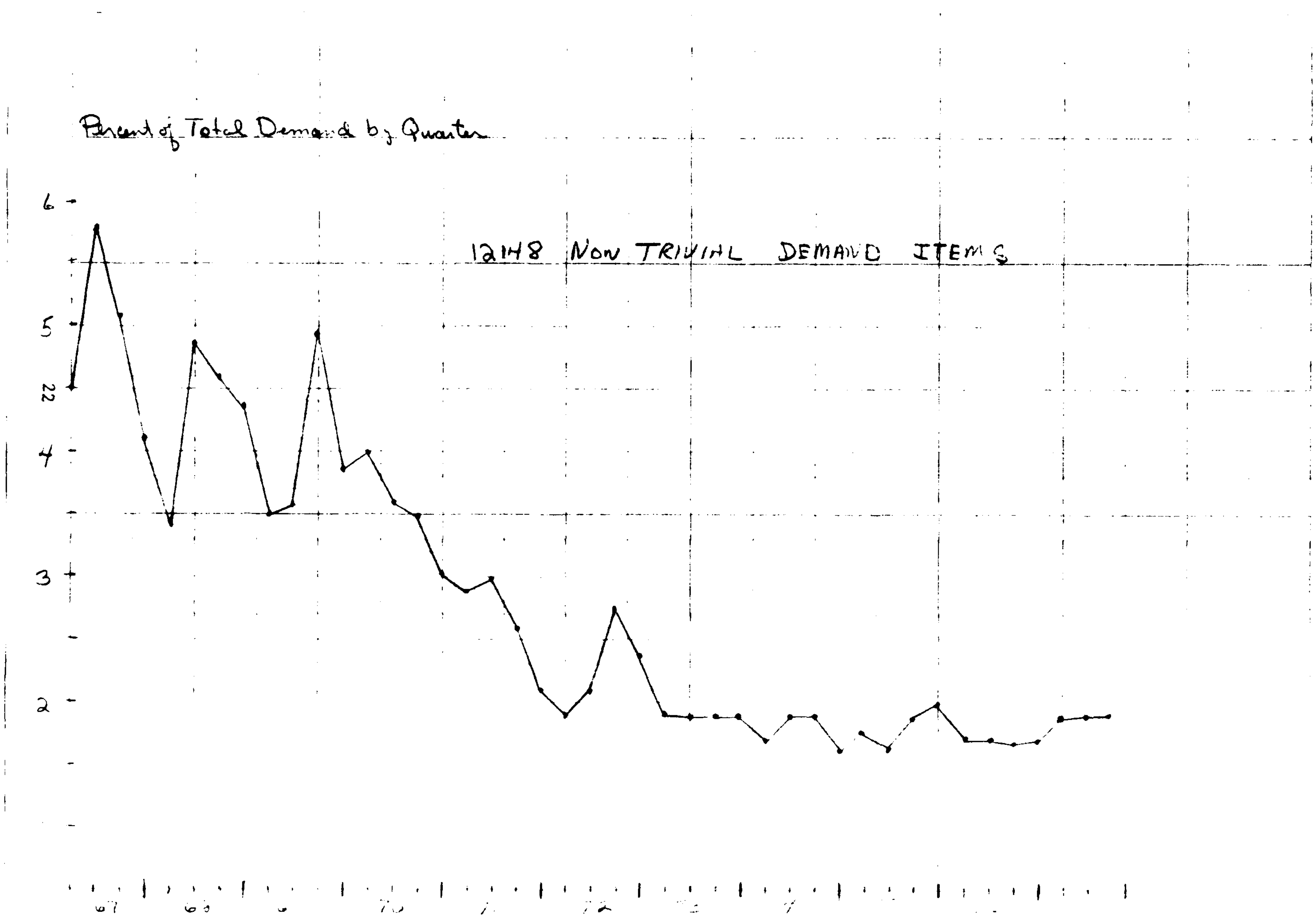
a. Nappe of the Earth (where the aircraft flies at tree level with extreme power surges to lift over obstacles).

b. Contour/low level flight (various altitudes).

c. Weight variation.

d. Special considerations.

Other conditions would affect failures. These include geographic conditions such as: sand, alkaline, ice, and snow, along with environmental conditions such as moisture, rain, heat, cold, and volcanic ash.


Percent of Total Demand by Quarter
12148 NON TRIVIAL DEMAND ITEMS
6
5
22
4
3
2
67
72

F... 3

Subsystems react differently to the mentioned classes (e.g. nappe of the earth flying would impact the engine system differently than it would the electrical systems) and should be considered separately when developing a failure rate model. The failures themselves are inherently different. They may be caused by age, malfunction, accident, improper use, stress, combat damage, or neglect. Each of these factors may confound the effects of sorties and flying hours and should be appraised during the analysis.

Another problem in dealing with failures is the association of the failure with a specific sortie or mission. Very seldom are failures detected in flight; most of them are observed during inspection (daily, pre-flight, post-flight) or during routine or scheduled maintenance. In either case the specific time into a flight or sortie of a failure is not observed and is lost for the analysis. Hence stress of takeoff and landing cannot be directly measured.

The mentioned considerations lend themselves to a classical experimental design where each of the factors would be controlled or blocked during the experiment. Such an experiment would be extremely expensive and is beyond the scope of this study. The lack of such a control of the environment precludes the development of a failure rate model per se and puts emphasis on developing general relationships gleaned subjectively from the aggregate data. The next section summarizes these subjective observations concerning failures.

4.5 Findings

As mentioned in the previous section there are many variables that may affect failures in addition to sorties and flying hours. Many of these are related to the variable in question and their effects would be difficult to differentiate without an extensive experimental design effort. Since the results of this study are to be applied to demand forecasting at the wholesale level, the environmental variables in terms of the aggregation may not vary much over time except possibly between peacetime and wartime periods.

The 1352 failure data (reliability/availability) as analyzed in the previous chapter did not correlate well with sorties, flying hours, or utilization. Similar analysis using SDC data for a single unit resulted in the same finding.

The IRO demand history file showed more demands during the Vietnam era than during peacetime. This corresponded to an increased flying hour program but the relationship was confounded due to the fact that many of the demands were generated from combat damage and other wartime conditions not directly related to flying hours.

CHAPTER V

CONCLUSIONS/RECOMMENDATIONS

5.1 Summary of Findings

The analysis presented in this study was done primarily on aggregate information. The direction of the study was dictated by the availability of data and many of the suggested models developed by others could not be directly tested. By looking at worldwide (peacetime) and Vietnam (wartime) data it was apparent that sorties for Army aircraft were quite a bit shorter in duration and less variable in absolute terms than those observed in earlier work done on fixed wing jet aircraft. This short duration of helicopter sorties made it impossible to detect any failure time pattern as demonstrated by Shurman.

Analysis of about 20 years of 1352 flying hour records for five aircraft consistently showed a high correlation between the number of sorties and flying hours. This finding was corroborated using three months of SDC data on Blackhawk helicopters collected during the Bright Star exercise.

The correlation analysis of the 1352 data was done separately for the wartime and peacetime data. For each of the four helicopters tested, the slope was estimated as approximately 3 (assuming a zero intercept, Slope = number of sorties flying hours) except for the AH-1 wartime data where the slope was estimated as 1.6 (longer sorties during wartime). For the OV-1 (the only fixed wing aircraft) the slope was 1.2 for peacetime and .57 for war also indicating longer sorties during war. These differences in slopes between systems and scenario indicate that if sorties do have an impact on failures then a different flying hour model should be used for different aircraft and scenarios, or sorties should be included in the model.

Another difference seen between the wartime and peacetime data was utilization. The utilization rate for wartime was three to six times that of peacetime. This difference in utilization should be considered for contingency planning.

Due to the paucity of failure data per se, several indirect methods of relating failures to flying hours and sorties were investigated. Using both 1352 reliability and availability statistics, there was no correlation found between these variables and sorties, flying hours or utilization. Similar findings were demonstrated using the SDC Bright Star data where maintenance events and maintenance manhours were regressed against sorties and flying hours. The IRO wholesale demand data did show increased demands for increases in flying hours but the

causes of increase in demand were confounded by wartime effects. Several other IRO studies indicated that the use of flying hour data improved the forecast for individual item demand at the wholesale level.

During the course of the study several Army aircraft experts were contacted and they all suggested that other factors such as mission, environment, and geographic location may have a greater effect on failures than do sorties and flying hours. The Boeing study [19] addressed these factors using Air Force data. These results suggested 29 different models to be used separately for different high failure equipment. Each model considered (multiple regression) as many as 54 explanatory variables. Results of this complexity would not be useful in the context of forecasting demand at the wholesale level. No additional analysis was performed on this topic.

5.2 Conclusions

This study was not able to show any relationship between failures and flying hours, sorties, or utilization. The data were limited in that other causal effects could not be removed from the analysis nor could the explanatory variables be controlled adequately to statistically quantify the study's findings. Other IRO studies did demonstrate the favorable use of flying hours in making demand forecasts and the lack of results of this study should not be construed as negating these findings.

5.3 Recommendations

The following is a list of recommendations based on the findings of this study:

a. Until stronger evidence is found to support the study findings, continue to use flying hours as a program variable for demand forecasting.

b. Continue to search for failure data where sortie, flying hour, and utilization effects can be statistically appraised and a failure rate model developed.

c. Contingency planners should be aware of the large differences in utilization observed between the wartime and peacetime data. Additional work should be considered where a usage model similar to Buck's [1] could be studied.

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APPENDIX A

AIRCRAFT USED IN STUDY

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SAMPLE DATA COLLECTION

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AND LOGISTIC MANAGEMENT QUARTERLY SUMMARY (PART B)
CH-47B/C, HELICOPTER
1 July - 31 December 1981

RCS DRCMM-156
PART A & B
DA CIR 750-37 - 49

CH-47

CHINOOK

PREPARED FOR:

US ARMY TROOP SUPPORT & A .TION MATERIAL READINESS COMMAND DIRECTORATE FOR PRODUCT ASSURANCE
SYSTEM PERFO. .NCE ASSESSMENT DIVISION
/ COBRO CORPORATION

DEPARTMENT OF THE ARMY
SAMPLE DATA COLLECTION

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AND LOGISTIC MANAGEMENT QUARTERLY SUMMARY (PART B)
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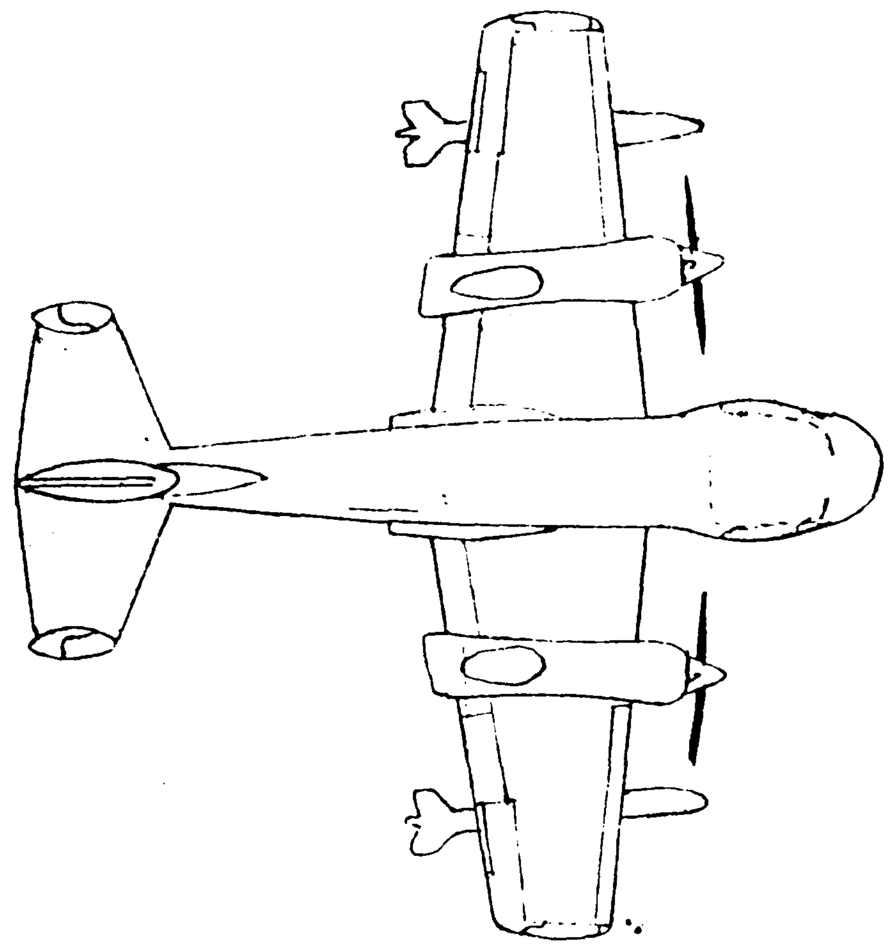

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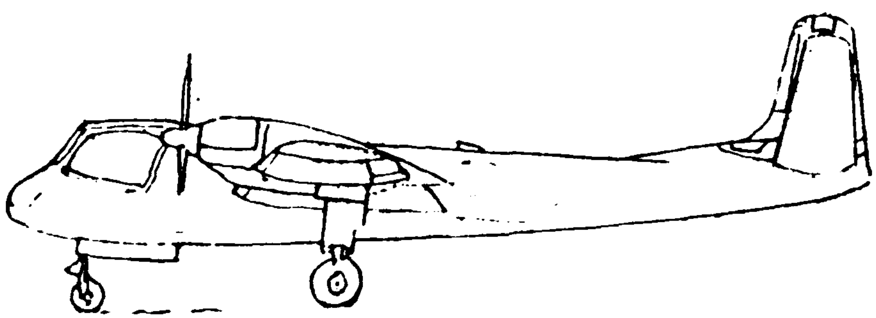

US ARMY TROOP SUPPORT & AVIATION MATERIEL READINESS COMMAND, DIRECTORATE FOR PRODUCT ASSURANCE
SYSTEM PERFORMANCE ASSESSMENT DIVISION
BY COBRO CORPORATION Apr 81

DEPARTMENT OF THE ARMY

SAMPLE DATA COLLECTION

LOGISTIC MANAGEMENT ANALYSIS QUARTERLY SUMMARY (PART A)
AND LOGISTIC MANAGEMENT QUARTERLY SUMMARY (PART B)
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PART A & B
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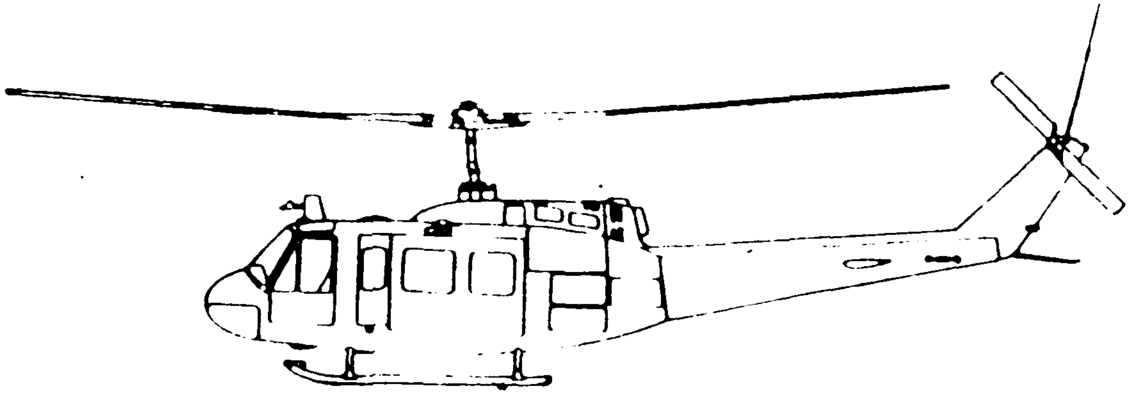

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DEPARTMENT OF THE ARMY
SAMPLE DATA COLLECTION

LOGISTIC MANAGEMENT ANALYSIS QUARTERLY SUMMARY (PART A)
AND LOGISTIC MANAGEMENT QUARTERLY SUMMARY (PART B)
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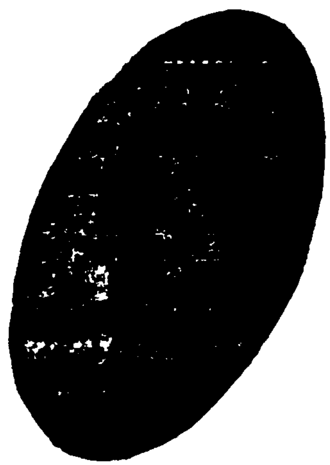
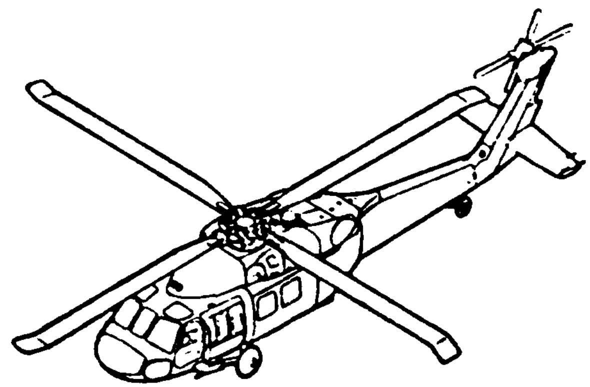
1 SEP 80 - 30 NOV 80

RCS DRCMM-156

PART A & B

DA CIR 750-37-57





PREPARED BY:
US ARMY TROOP SUPPORT & AVIATION MATERIAL READINESS COMMAND DIRECTORATE FOR PRODUCT ASSURANCE
SYSTEM PERFORMANCE ASSESSMENT DIVISION

DEPARTMENT OF THE ARMY

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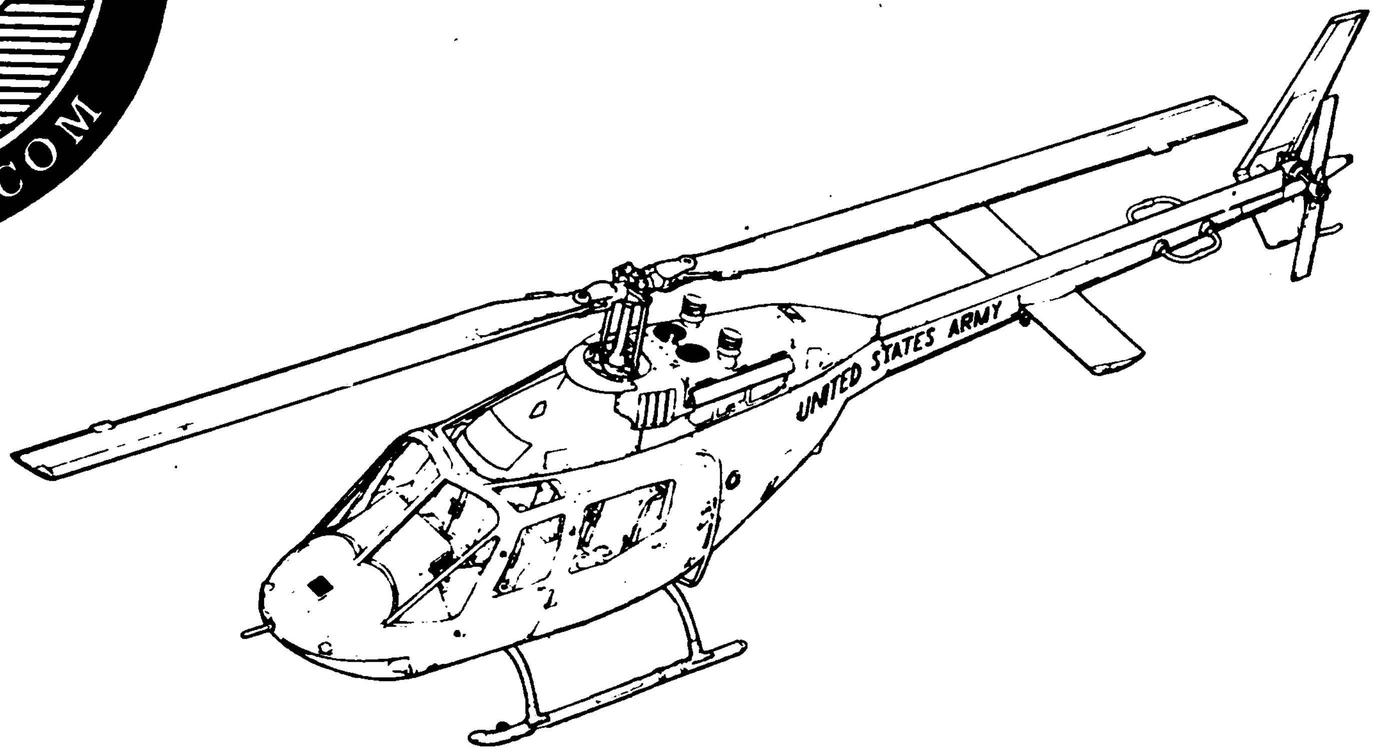

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DEPARTMENT OF THE ARMY

SAMPLE DATA COLLECTION

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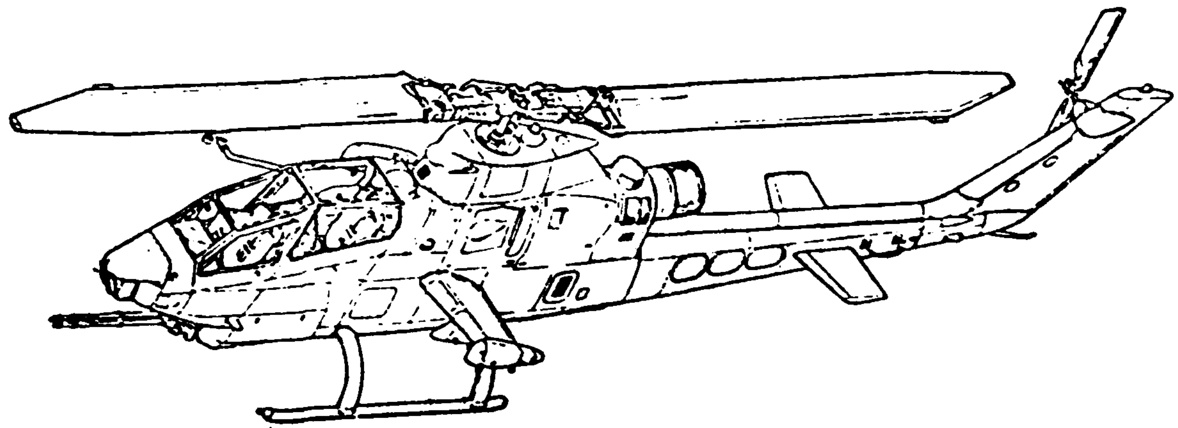

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APPENDIX B

DEFINITION - 1352 VARIABLES

Data Elements	Definitions
a. Density	The number of aircraft reporting data within the quarter.
b. Number of Reporting Units	The number of units reporting data within quarter.
c. Total Flying Hours	The sum of all hours flown within the quarter.
d. Avg Hours On Hand	The average hours on hand per aircraft for for the quarter.
e. Standard Deviation of Hours On Hand	Standard Deviation of (d).
f. Avg Usage	The average (flying hours ÷ hours on hand) per aircraft for the quarter.
g. Standard Deviation of Usage	Standard Deviation of (f).
h. Total Number of Sorties	The sum of all landings reported within the quarter.
i. Avg Length of Sortie(Duration)	c ÷ h (Total Flying Hours ÷ Total Sorties)*
j. Avg Length of Sortie by Aircraft (Duration)	The average (flying hours ÷ number of landings) per aircraft for the quarter.**
k. Standard Deviation of Length of Sortie by Aircraft	The standard deviation of (j).
L. Avg Reliability	The average ((hours on hand - hours not mission capable due to maintenance) ÷ hours on hand) per aircraft for the quarter.
m. Std Dev of Reliability	Standard deviation of (L).
n. Avg Availability	The average ((partial mission capable + full mission capable) ÷ hrs on hand) per aircraft for the quarter.
o. Standard Deviation of Availability	Standard deviation of (n).
p. Number of Autorotations	The sum of all autorotations reported within the quarter.

*Fleet Ratio

**Average Ratio of Each Tail Number

APPENDIX C

1352 DATA TIME SERIES

Variables

Density

Number of Reporting Units

Total Flying Hours

Avg Hours on Hand

Standard Deviation of Hours On Hand

Avg Usage

Standard Deviation of Usage

Total Number of Sorties

Avg Length of Sortie

Avg Length of Sortie by Aircraft

Standard Deviation of Length of Sortie by Aircraft

Avg Reliability

Std Dev of Reliability

Avg Availability

Standard Deviation of Availability

Number of Autorotations

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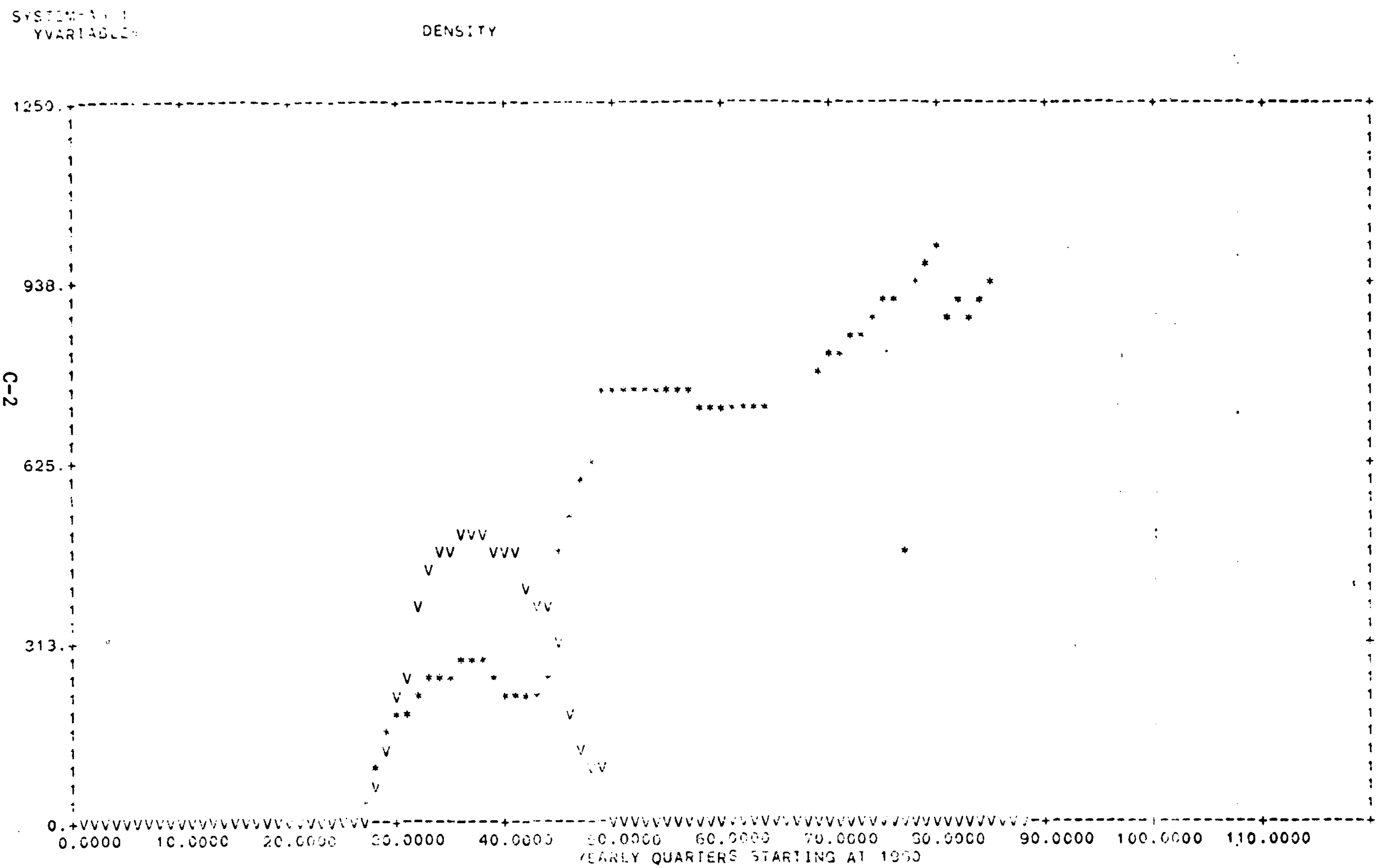

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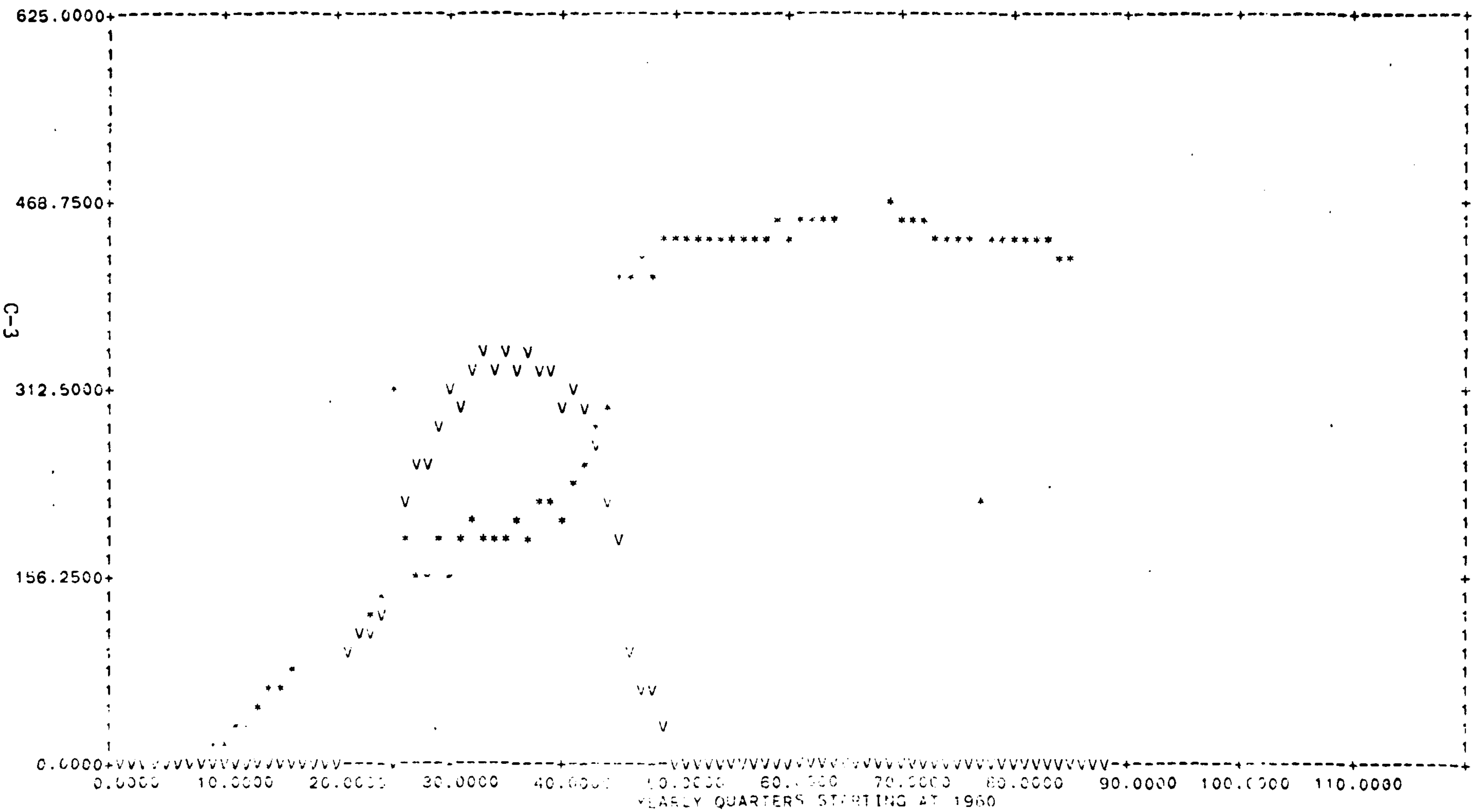

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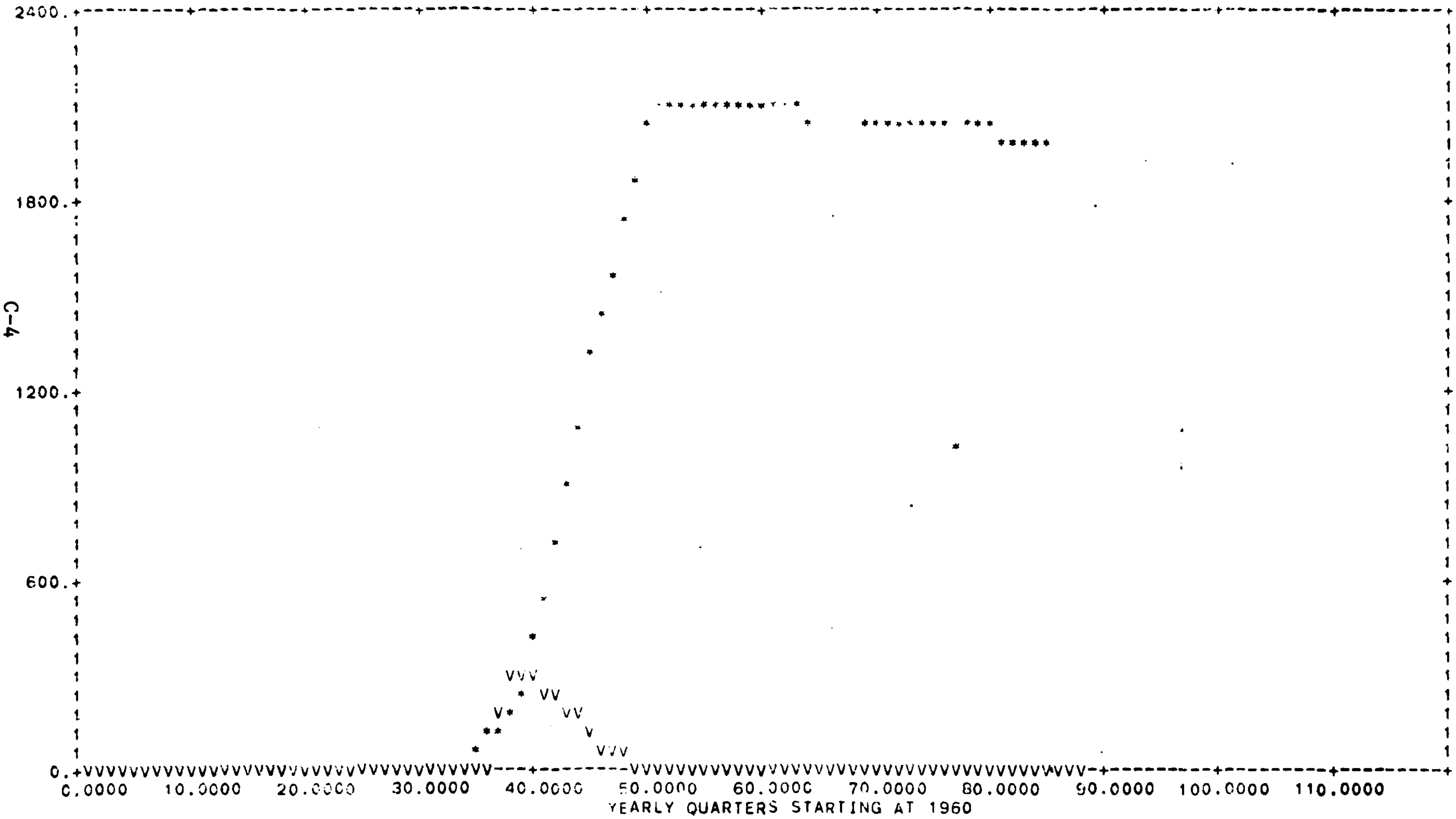
SYSTEM=OH58
YVARIABLE=　　DENSITY



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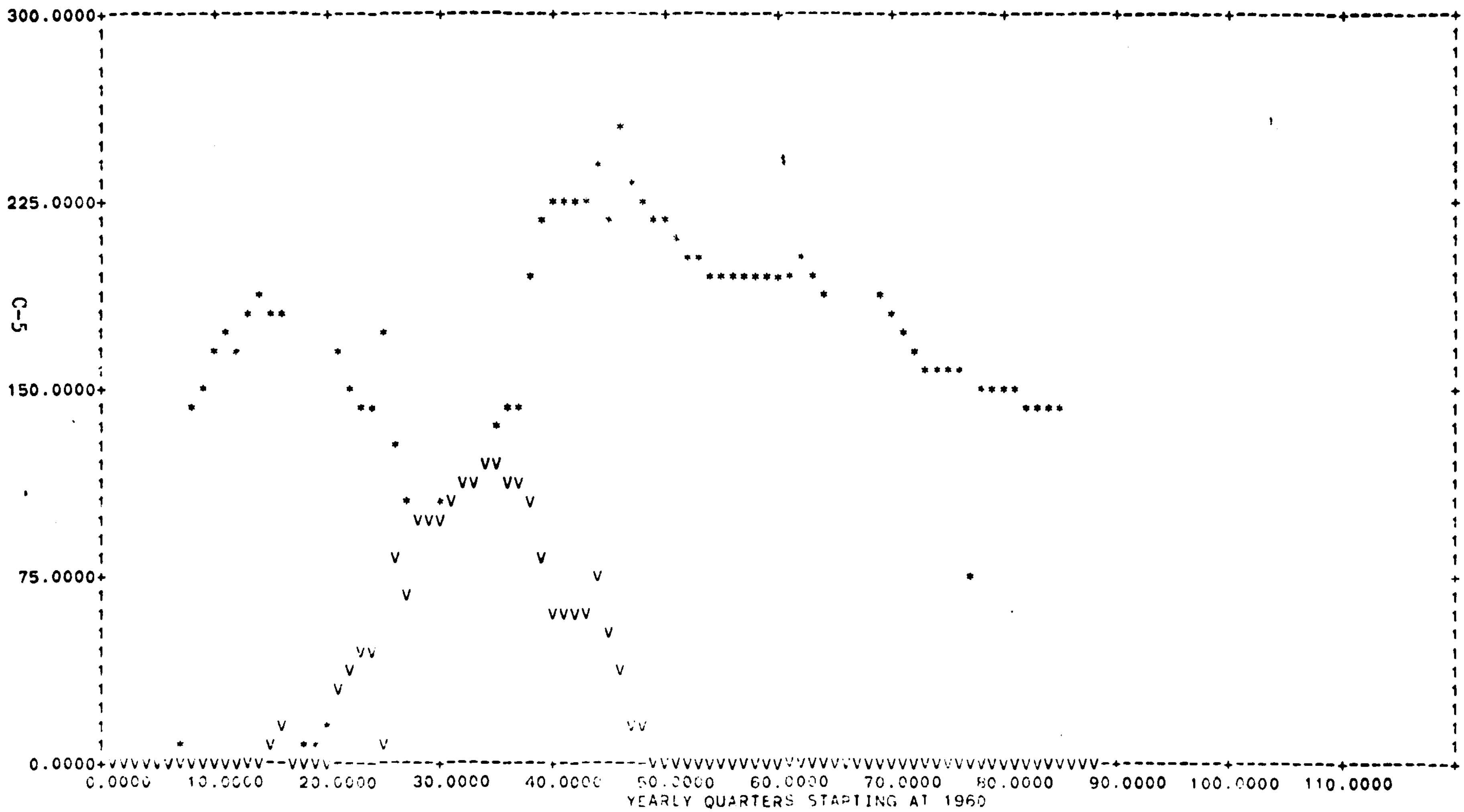

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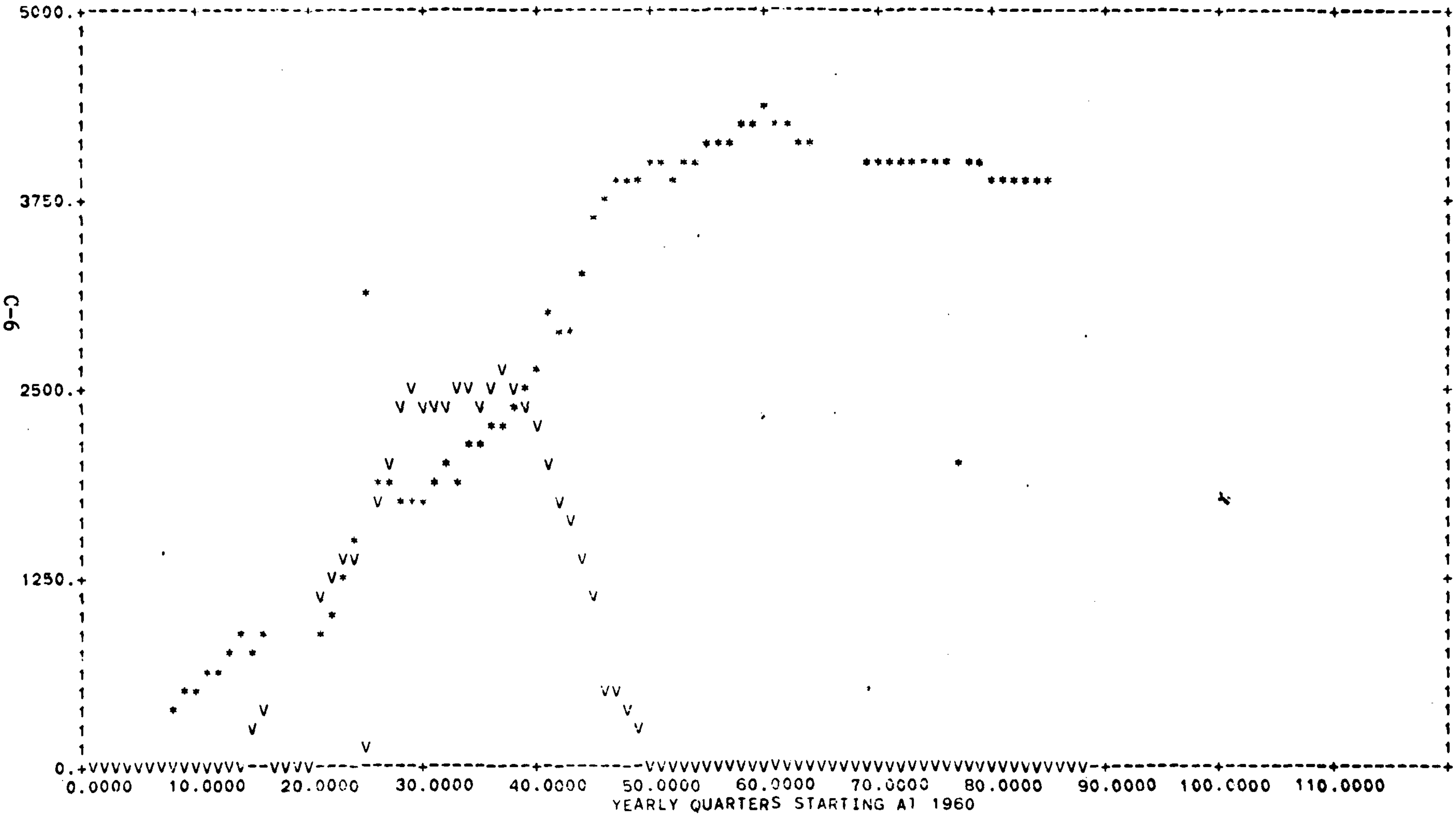

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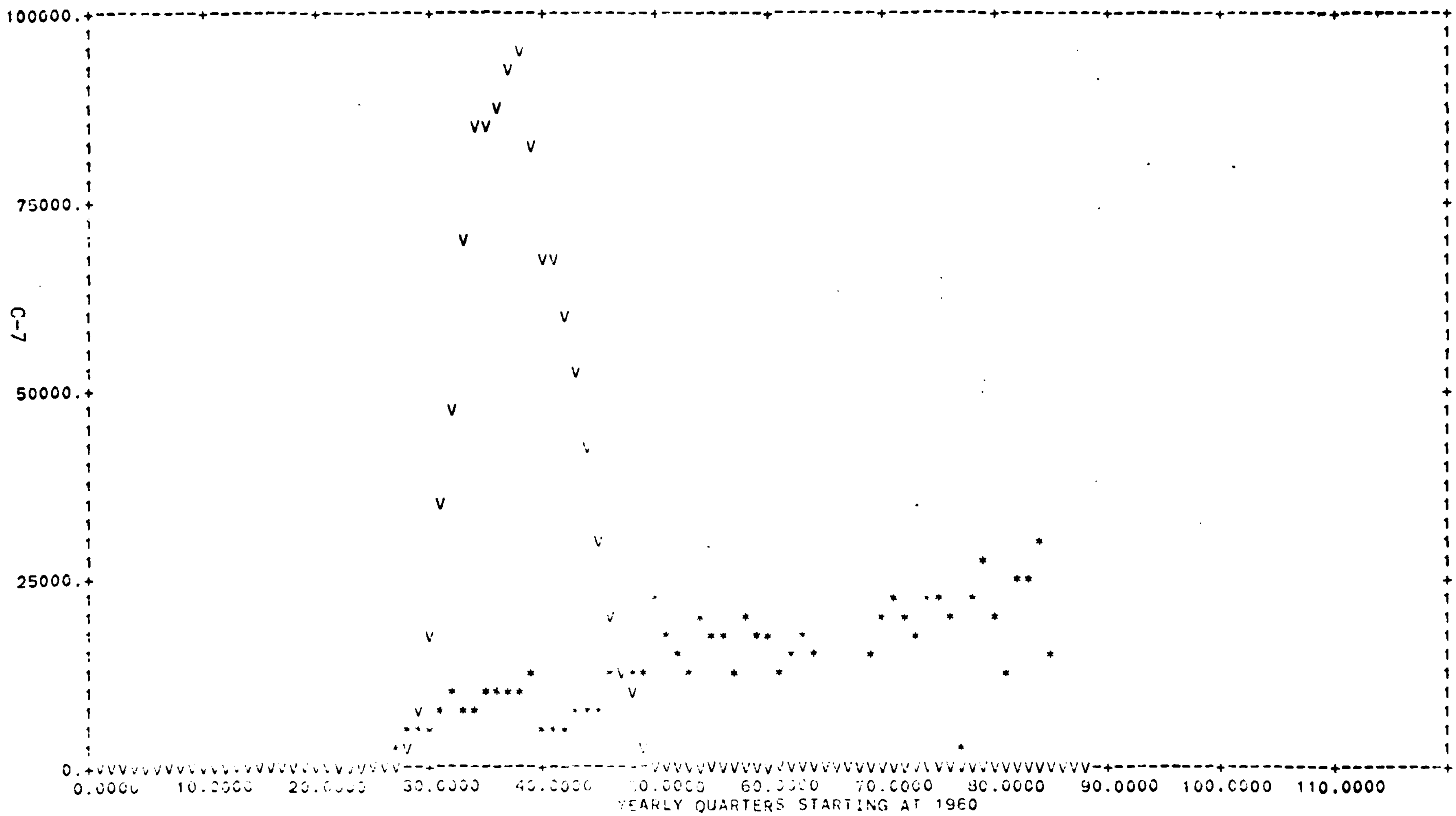

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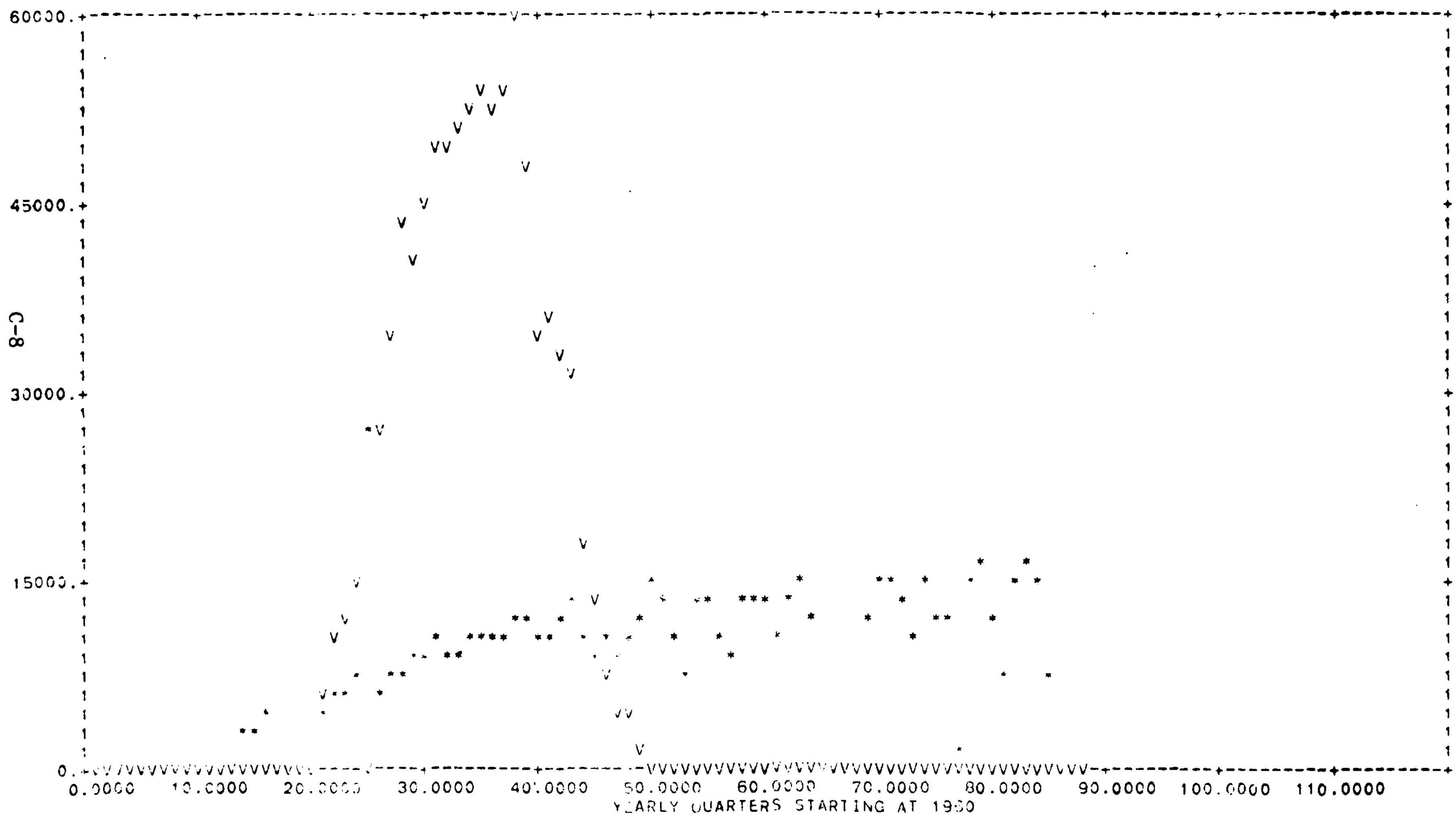

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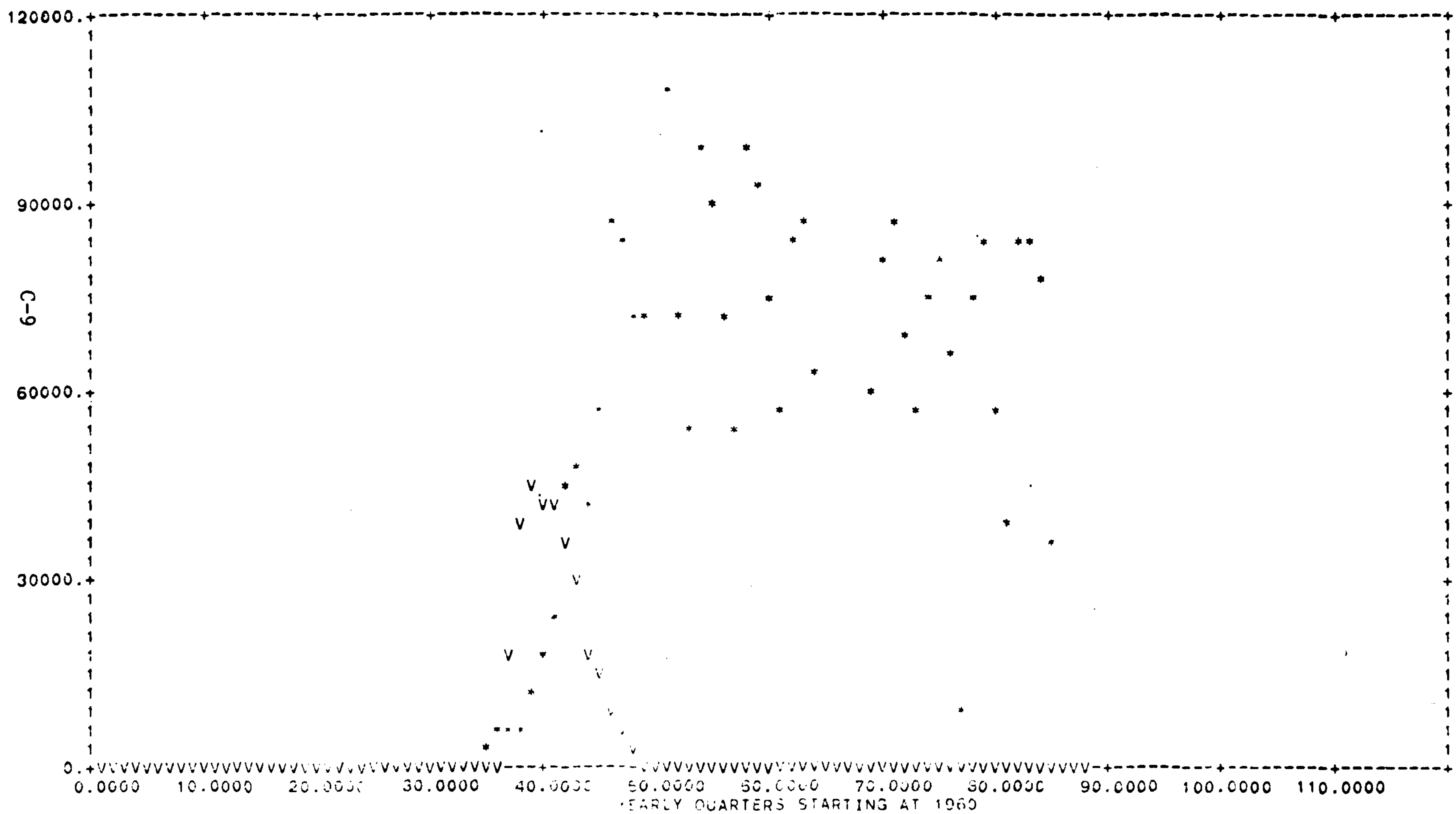

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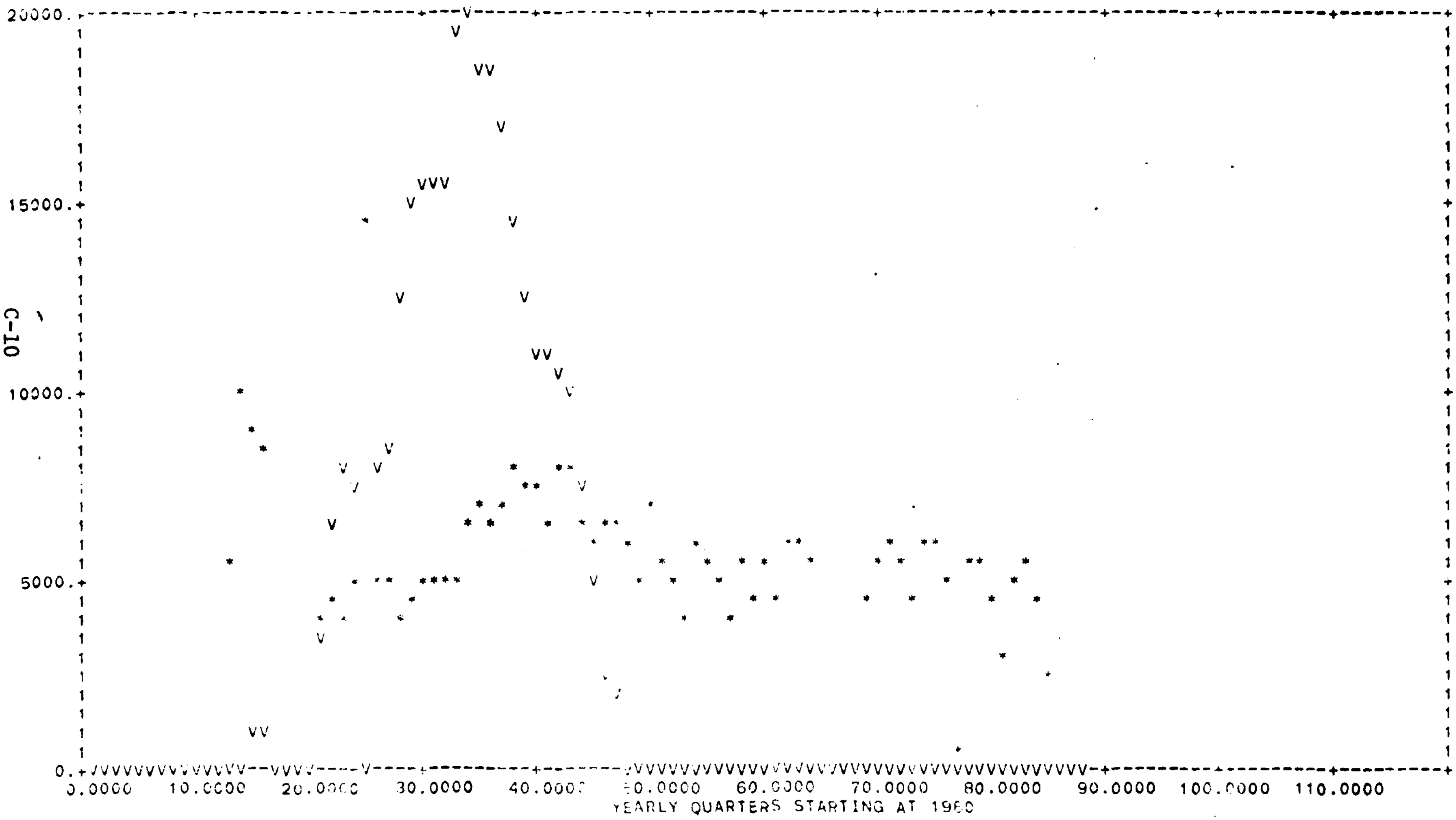
TOTAL FLYING HOURS



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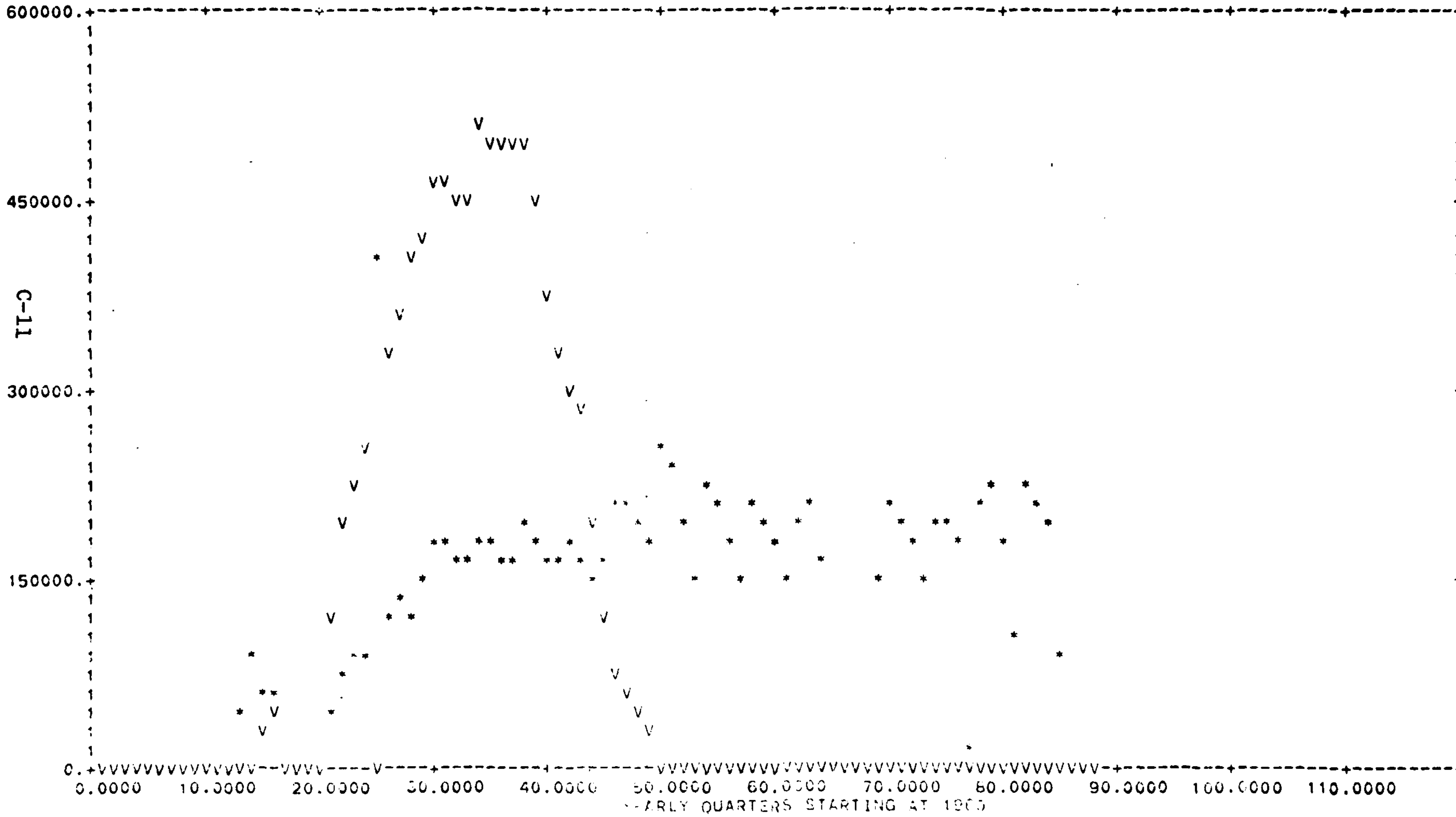

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VIETNAM AVERAGE= 29864[illegible].87 STANDARD DEVIATION= 169784.4[illegible]3 NUMBER OF OBSERVATIONS= 30

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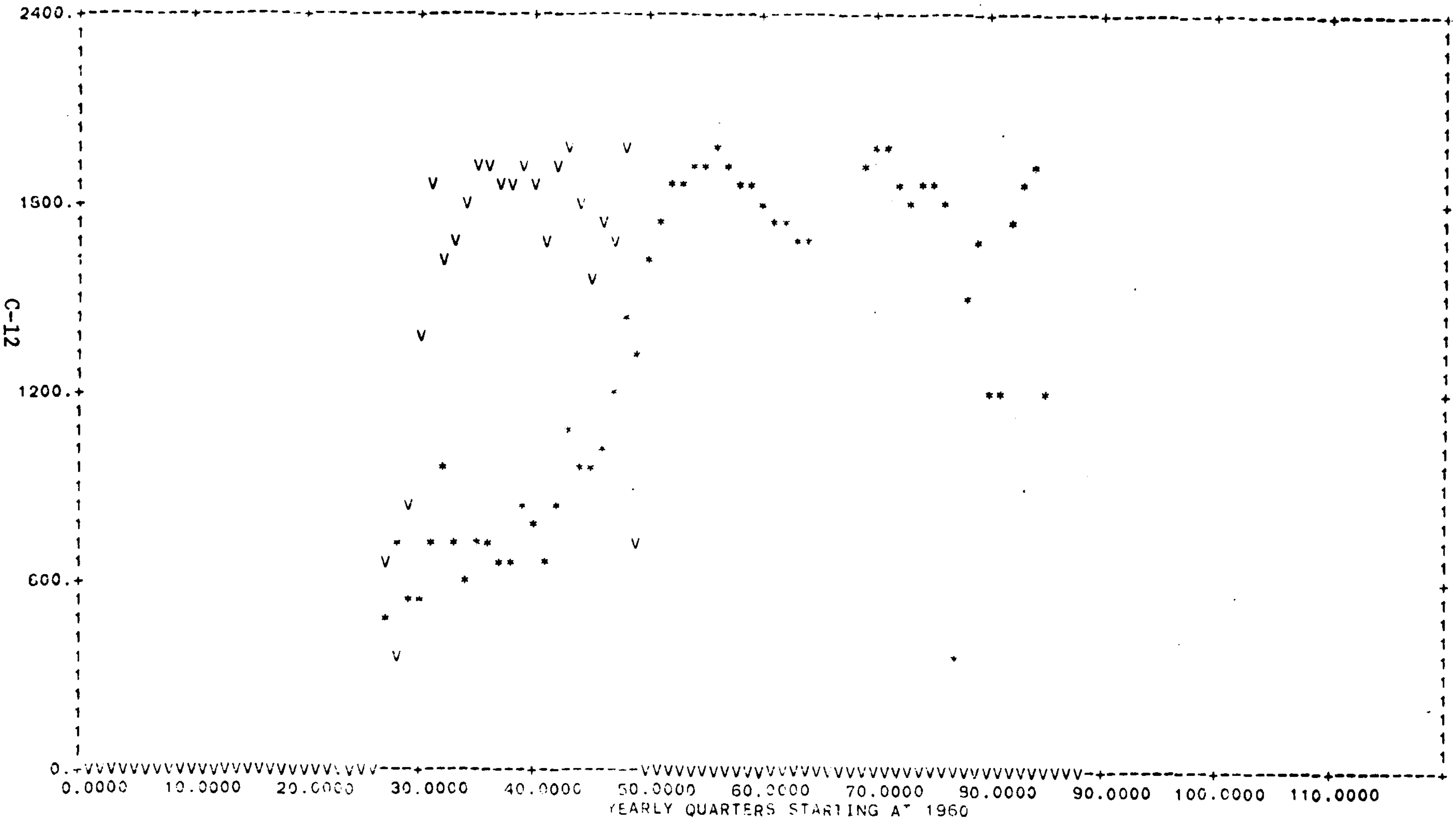
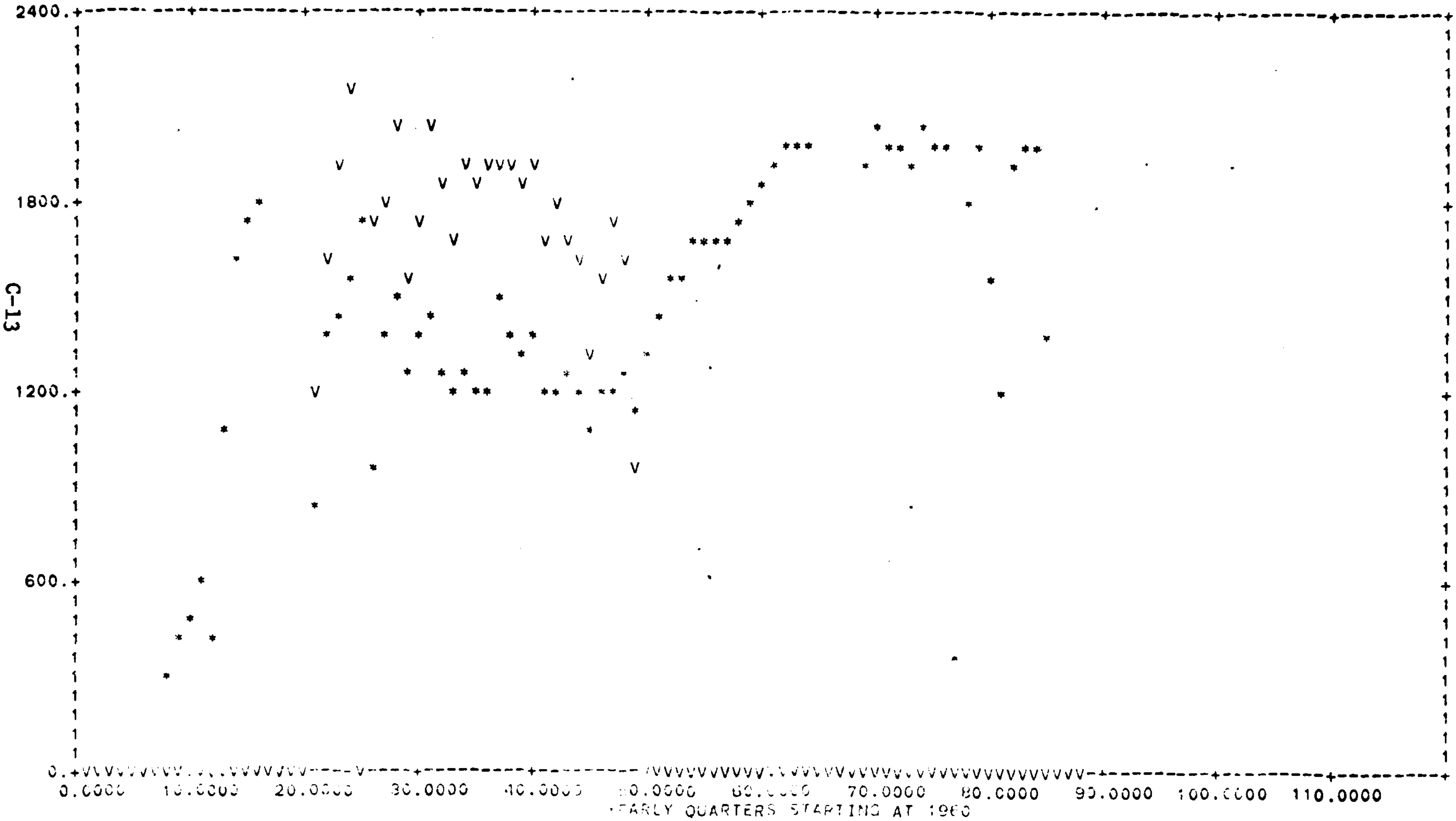
YVARIABLE= AVG HOURS ON HAND



WORLDWIDE AVERAGE= 1345.65 STANDARD DEVIATION= 533.1166 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= 1590.82 STANDARD DEVIATION= 472.0006 NUMBER OF OBSERVATIONS= 23

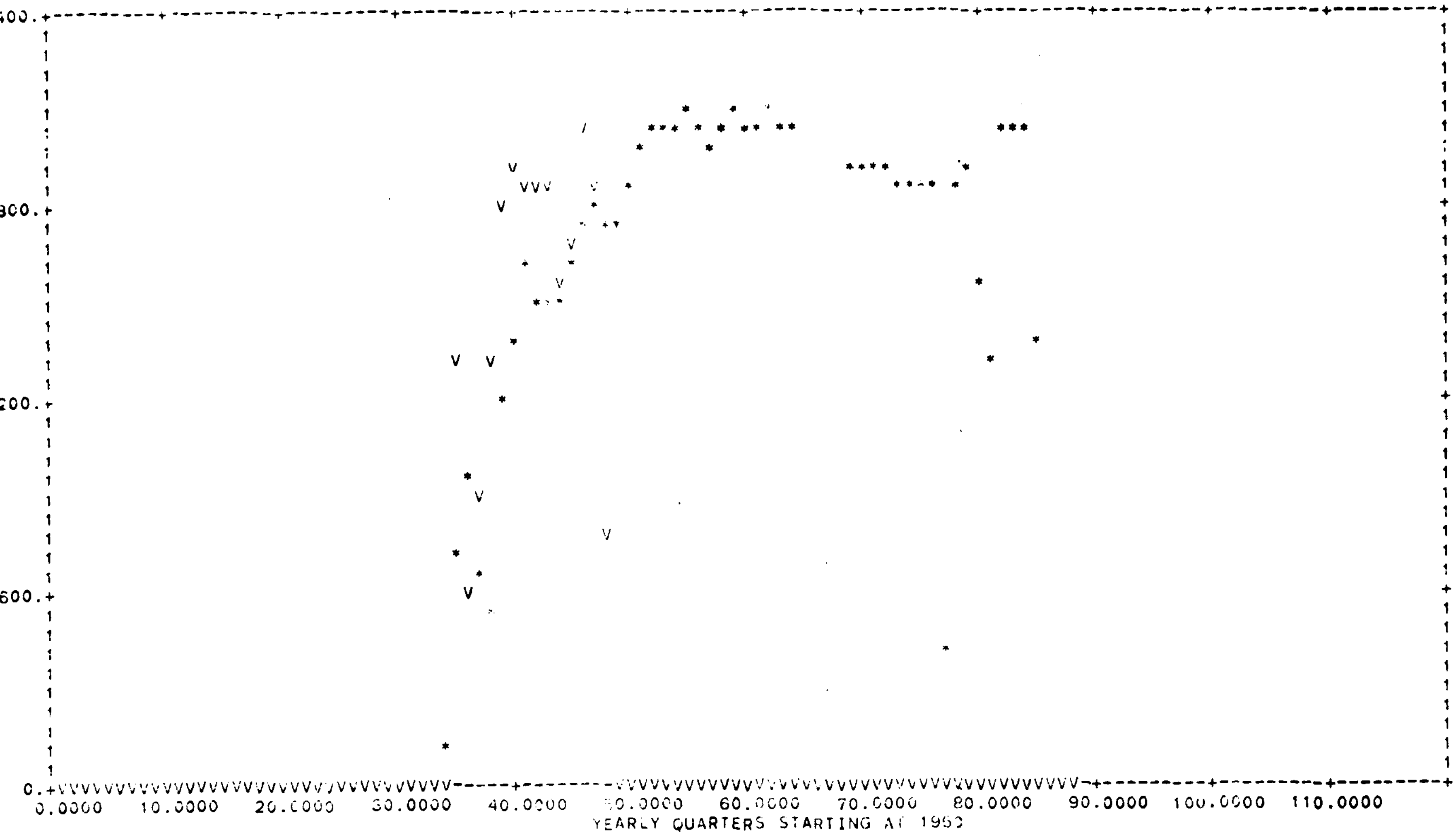
SYSTEM=CH47
YVARIABLE=

AVG HOURS ON HAND



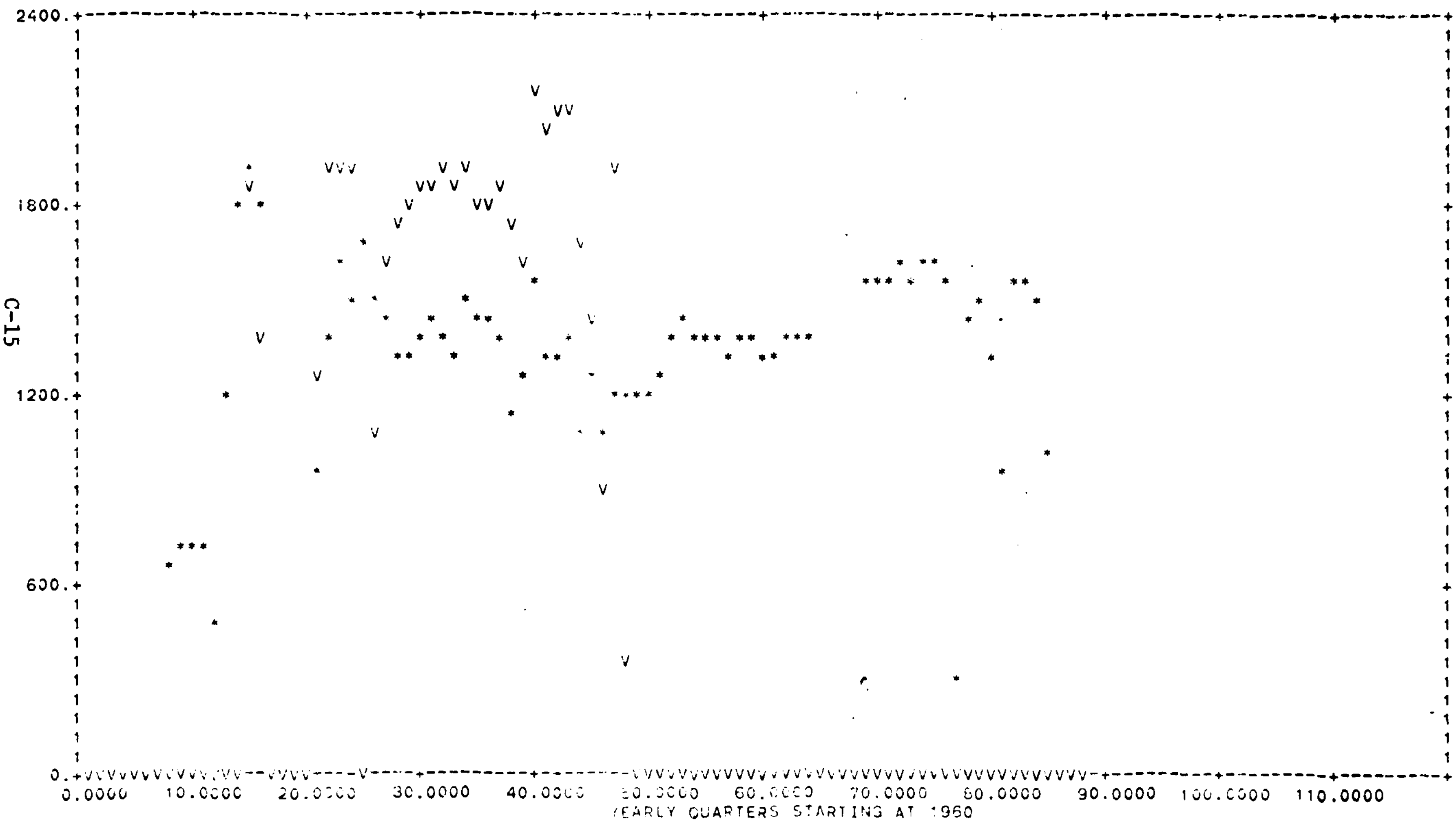
WORLDWIDE AVERAGE= [illegible].47 STANDARD DEVIATION= 440.98[illegible]9 NUMBER OF OBSERVATIONS= 70
VIETNAM AVERAGE= 17[illegible].18 STANDARD DEVIATION= 257.04[illegible]7 NUMBER OF OBSERVATIONS= 28

SYSTEM=OMSB
YVARIABLE= AVG HOURS ON HAND



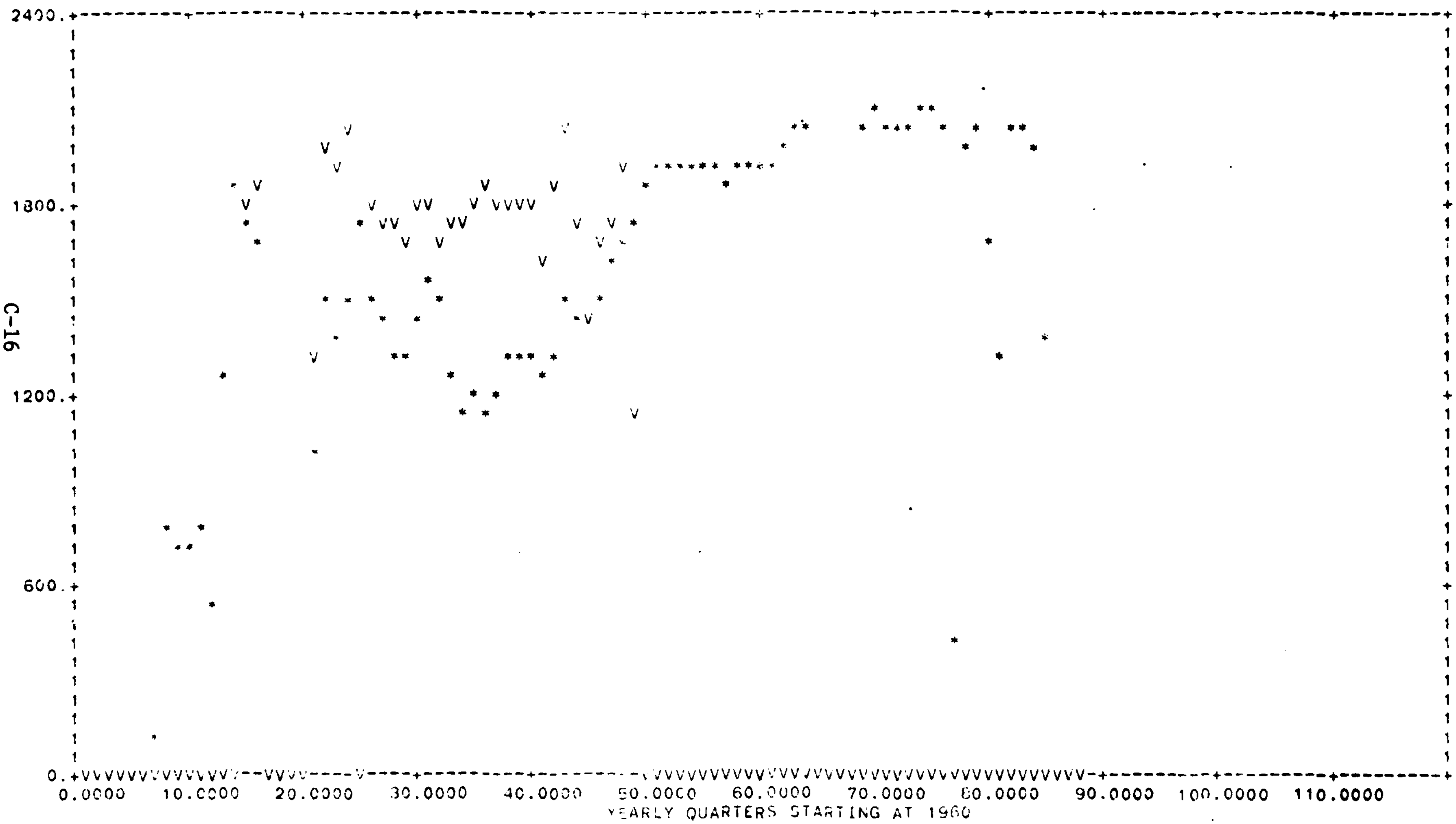
WORLDWIDE AVERAGE=	1674.65	STANDARD DEVIATION=	493.6352	NUMBER OF OBSERVATIONS=	48
VIETNAM AVERAGE=	1525.02	STANDARD DEVIATION=	472.2517	NUMBER OF OBSERVATIONS=	14

SYSTEM=OV-1
YVARIABLE= AVG HOURS ON HAND



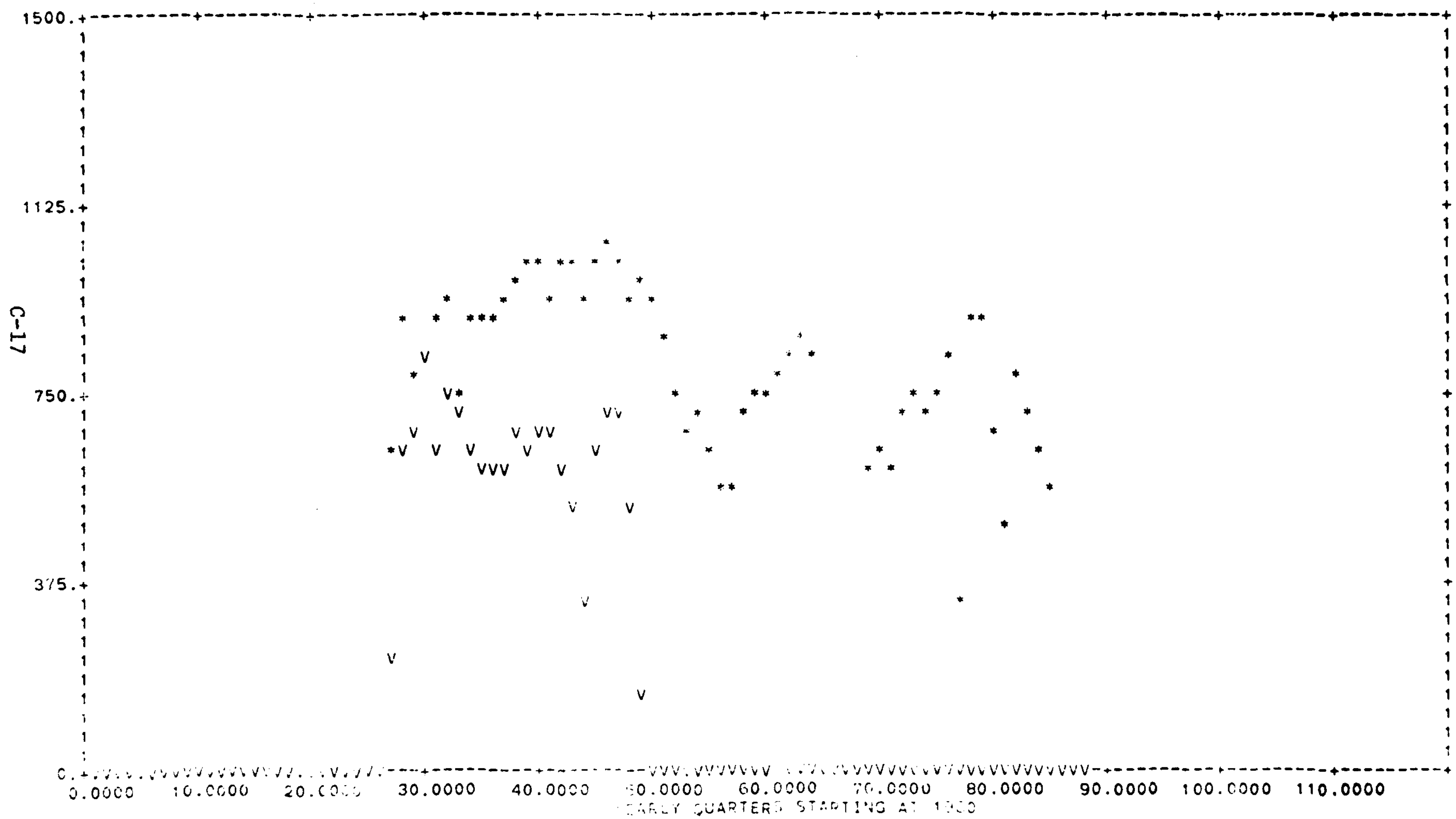
WORLDWIDE AVERAGE= 1332.69 STANDARD DEVIATION= 293.3083 NUMBER OF OBSERVATIONS= 70
VIETNAM AVERAGE= [illegible] STANDARD DEVIATION= 338.5353 NUMBER OF OBSERVATIONS= 29

SYSTEM=UH-1
YVARIABLE= AVG HOURS ON HAND



WORLDWIDE AVERAGE=	1563.50	STANDARD DEVIATION=	445.2417	NUMBER OF OBSERVATIONS=	71
VIETNAM AVERAGE=	1754.13	STANDARD DEVIATION=	187.7075	NUMBER OF OBSERVATIONS=	30

SYSTEM=AH-1
YVARIABLE= STANDARD DEVIATION OF HOURS ON HAND

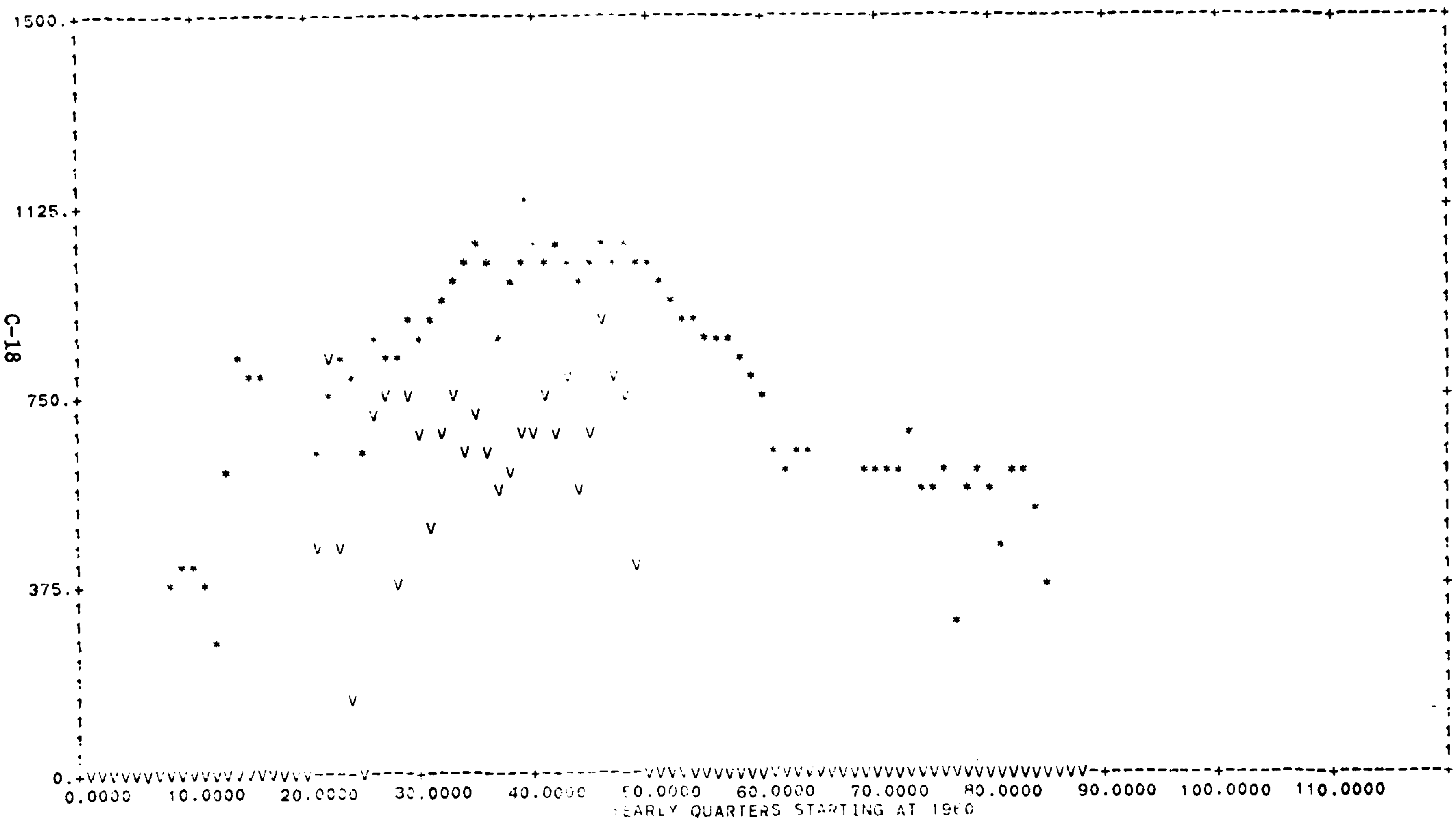


C-17

WORLDWIDE AVERAGE=	802.41	STANDARD DEVIATION=	156.4037	NUMBER OF OBSERVATIONS=	55
VIETNAM AVERAGE=	[illegible]	STANDARD DEVIATION=	162.4461	NUMBER OF OBSERVATIONS=	23

SYSTEM CHR7
YVARIABLE-

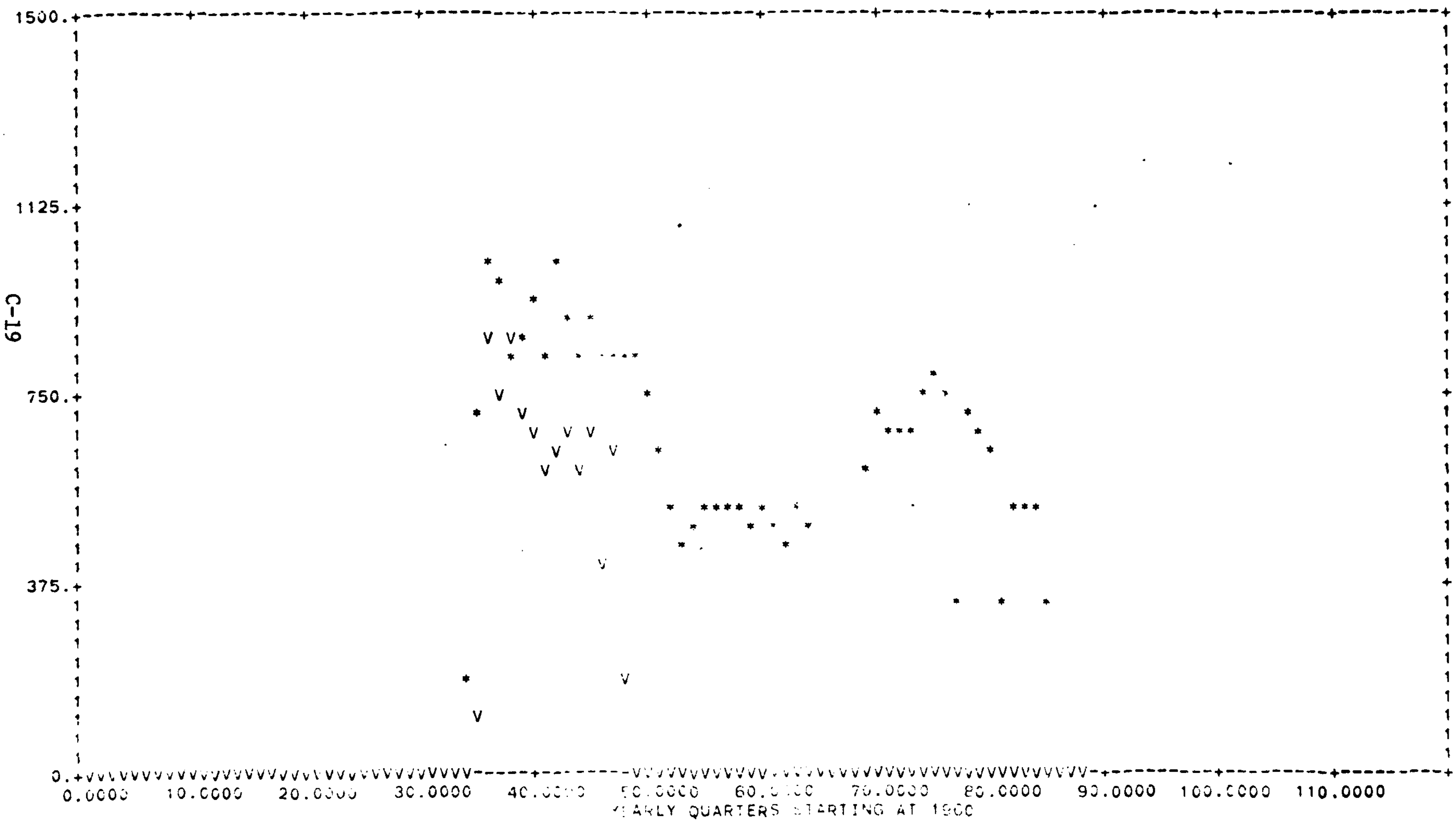
STANDARD DEVIATION OF HOURS ON HAND



WORLDWIDE AVERAGE=	759.18	STANDARD DEVIATION=	215.2004	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	540.11	STANDARD DEVIATION=	150.9575	NUMBER OF OBSERVATIONS=	28

SYSTEM=OH58
YVARIABLE=

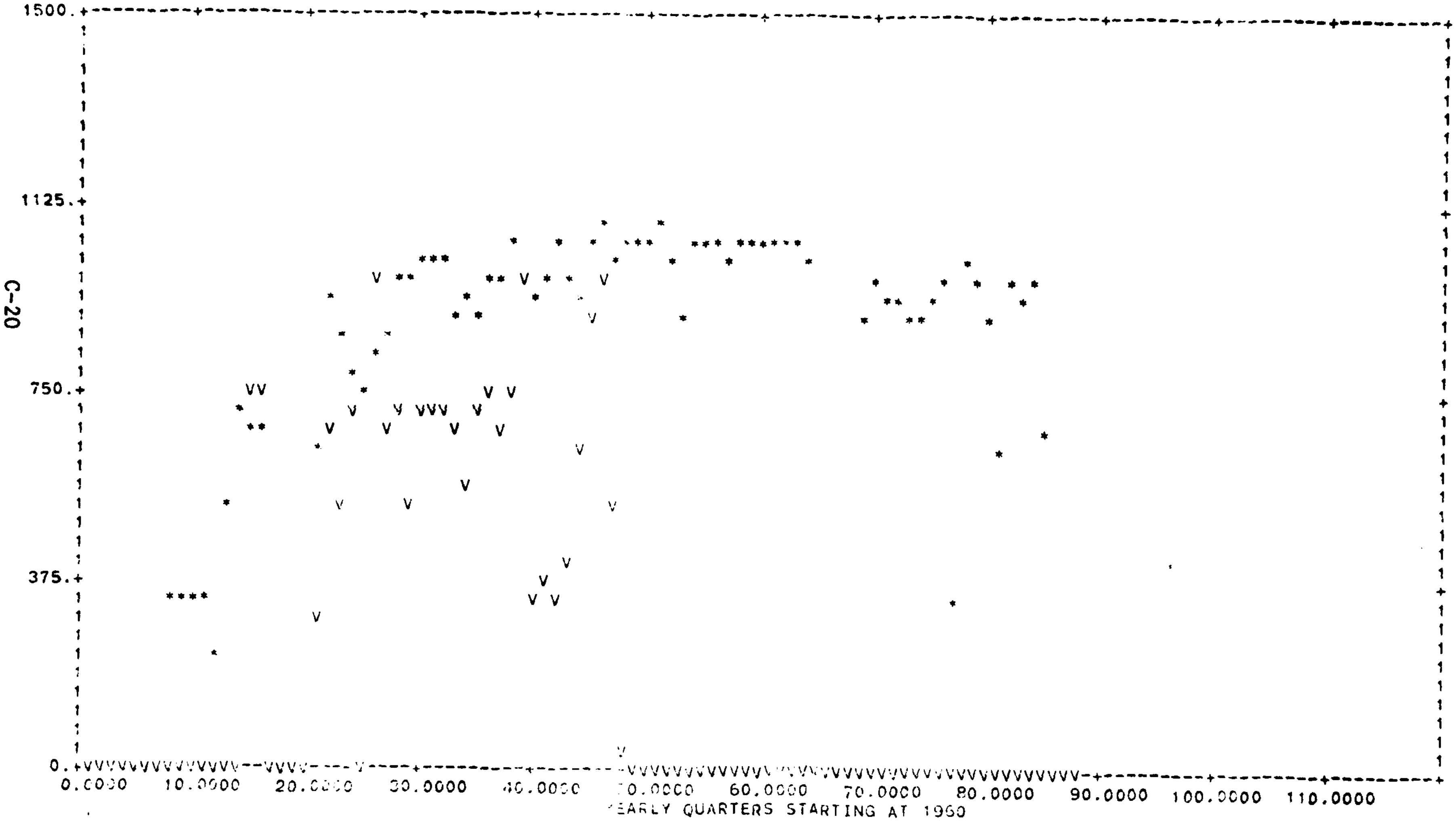
STANDARD DEVIATION OF HOURS ON HAND



WORLDWIDE AVERAGE= 653.93 STANDARD DEVIATION= 191.9196 NUMBER OF OBSERVATIONS= 48
VIETNAM AVERAGE= 5?4.67 STANDARD DEVIATION= 216.0029 NUMBER OF OBSERVATIONS= 14

SYSTEM=CV-1
YVARIABLE=

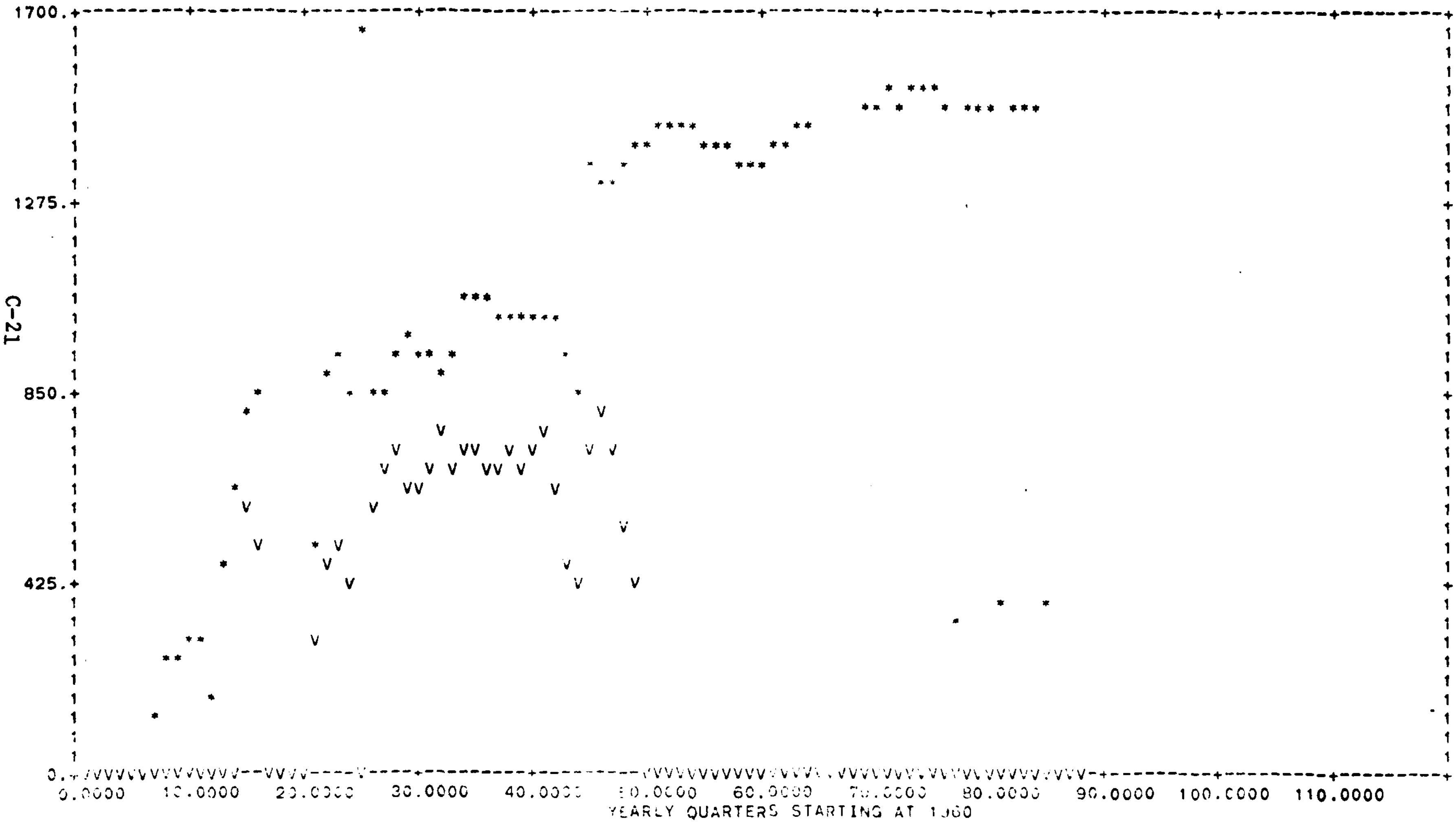
STANDARD DEVIATION OF HOURS ON HAND



WORLDWIDE AVERAGE=	986.57	STANDARD DEVIATION=	212.0140	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	633.13	STANDARD DEVIATION=	216.1561	NUMBER OF OBSERVATIONS=	29

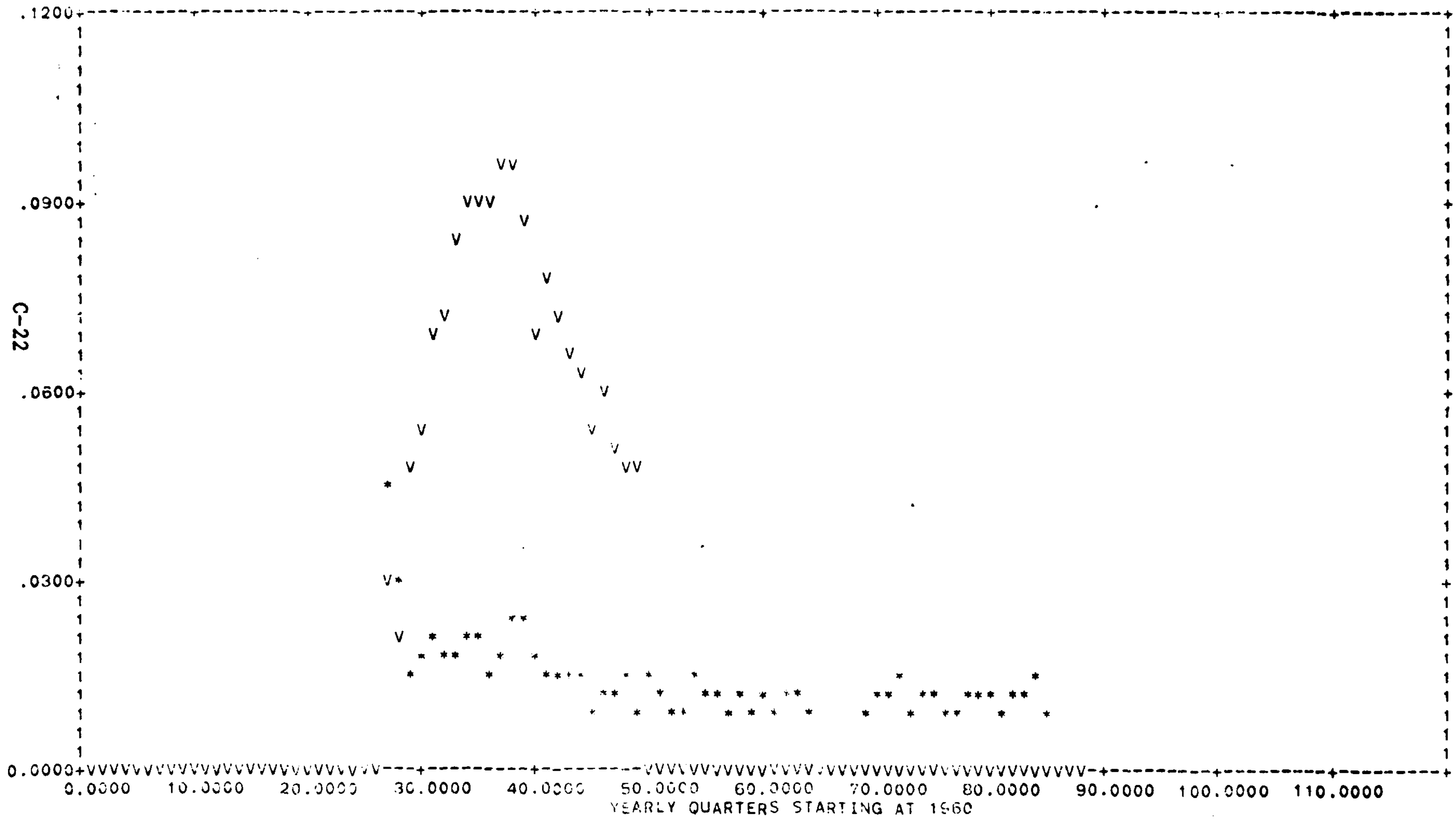
SYSTEM=UH-1
YVARIABLE=

STANDARD DEVIATION OF HOURS ON HAND



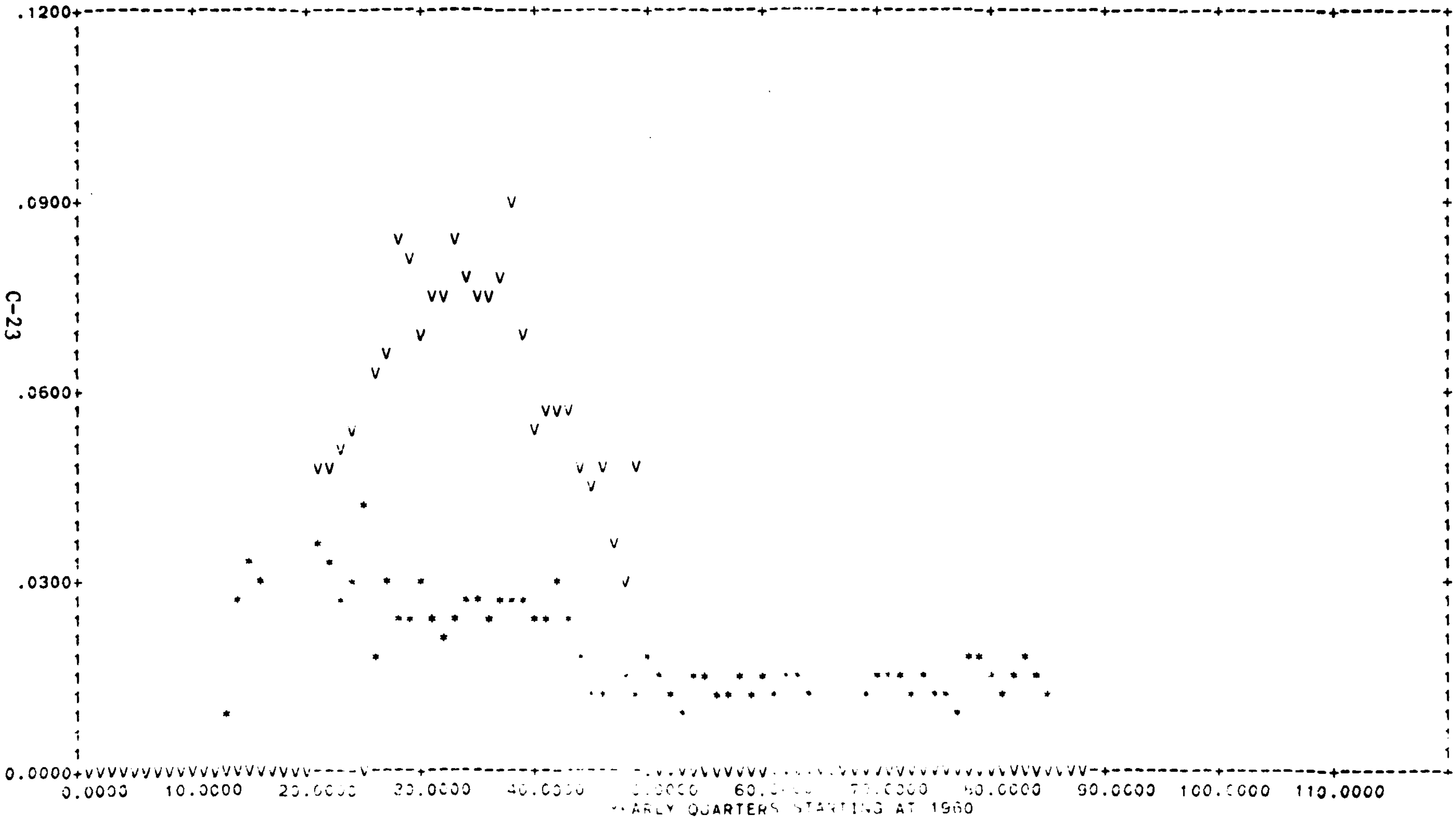
WORLDWIDE AVERAGE=	1089.60	STANDARD DEVIATION=	416.0741	NUMBER OF OBSERVATIONS=	71
VIETNAM AVERAGE=	6[illegible]3.19	STANDARD DEVIATION=	126.0114	NUMBER OF OBSERVATIONS=	30

SYSTEM=AH-1
YVARIABLE=   AVERAGE USAGE



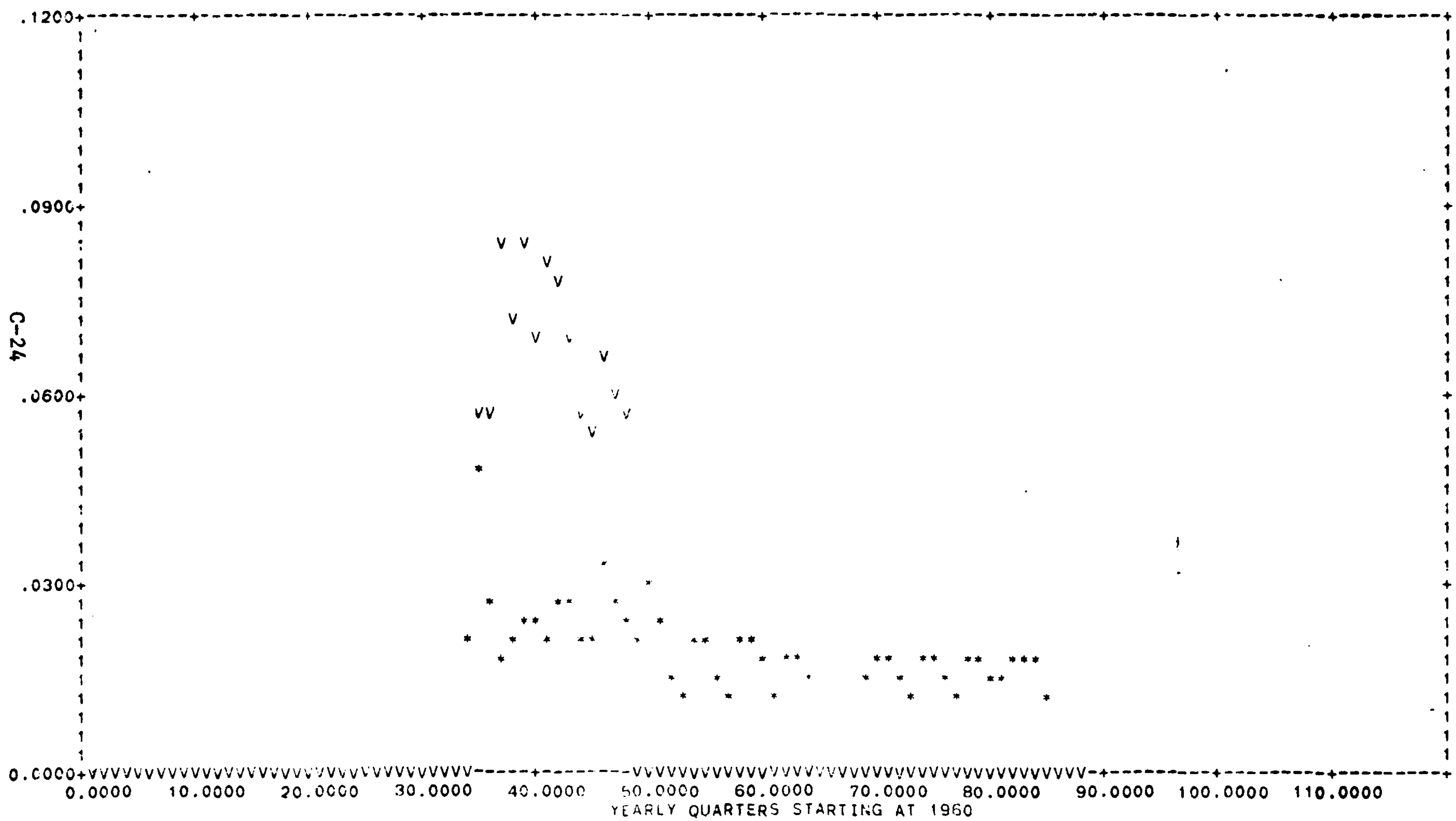
WORLDWIDE AVERAGE=	.01	STANDARD DEVIATION=	.0063	NUMBER OF OBSERVATIONS=	55
VIETNAM AVERAGE=	.07	STANDARD DEVIATION=	.0208	NUMBER OF OBSERVATIONS=	23

SYSTEM=CH47
YVARIABLE= AVERAGE USAGE



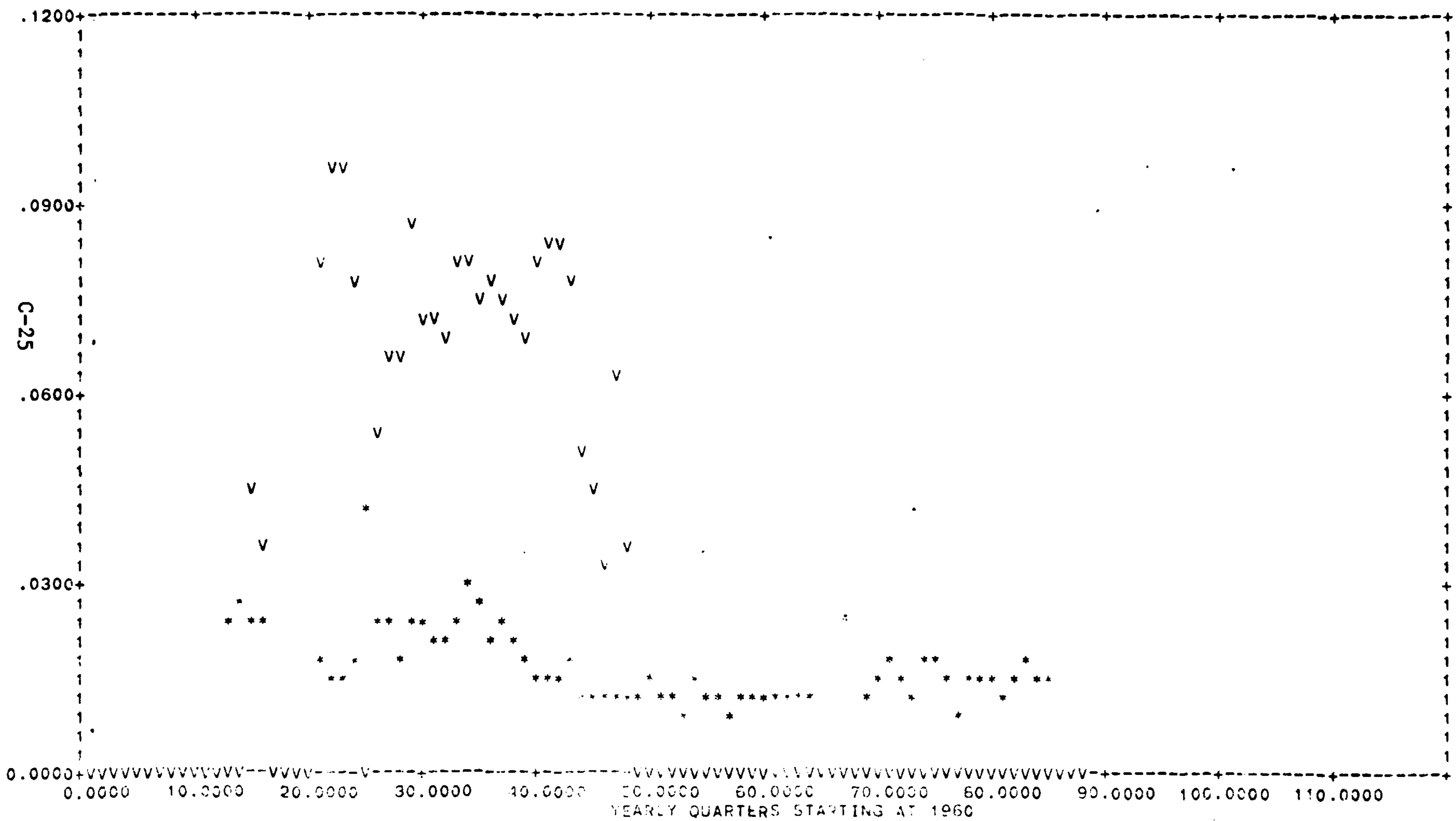
WORLDWIDE AVERAGE= .02 STANDARD DEVIATION= NUMBER OF OBSERVATIONS= 65
VIETNAM AVERAGE= .06 STANDARD DEVIATION= NUMBER OF OBSERVATIONS= 28

SYSTEM-OH58
YVARIABLE= AVERAGE USAGE



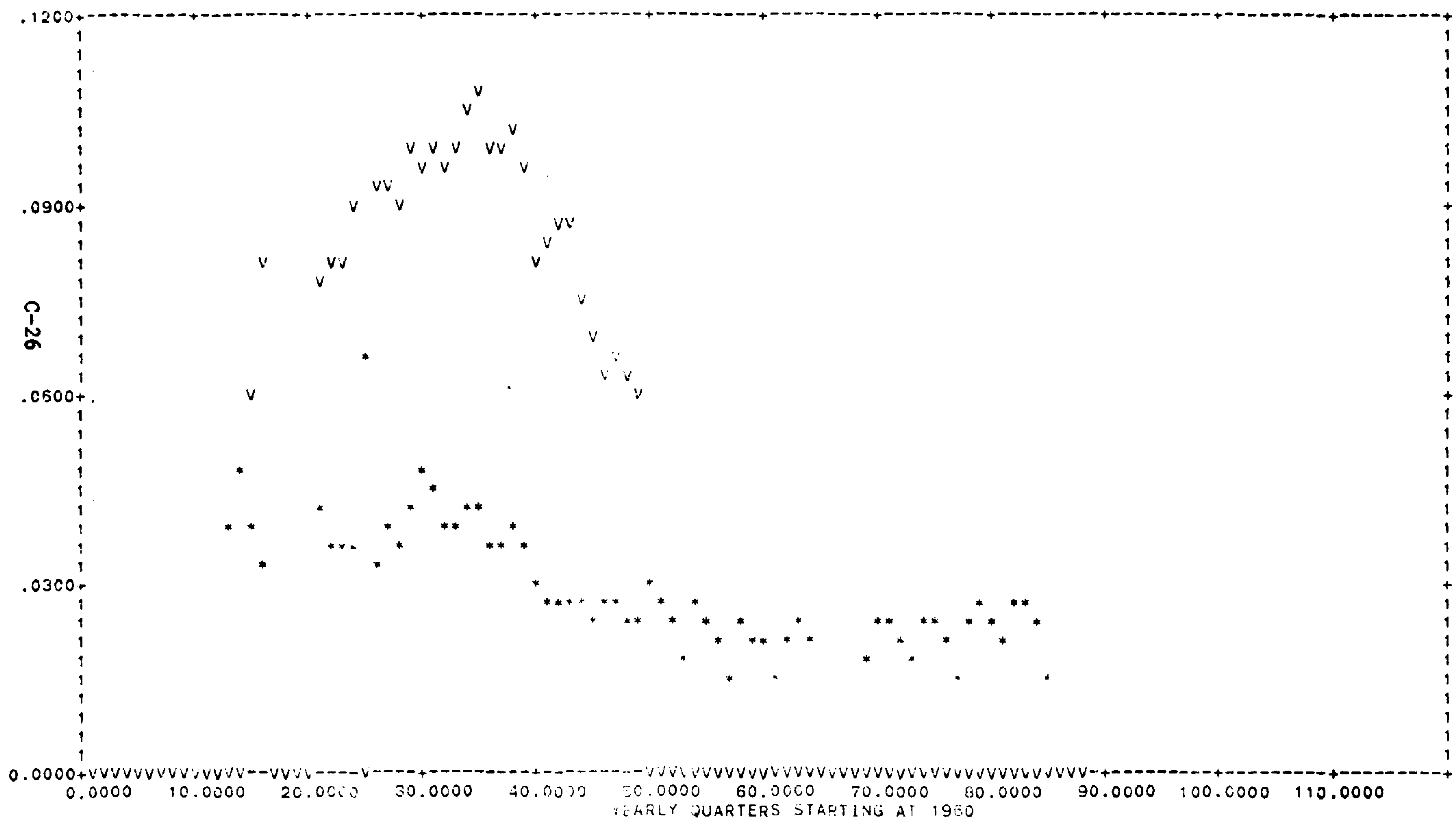
WORLDWIDE AVERAGE=	.02	STANDARD DEVIATION=	.0065	NUMBER OF OBSERVATIONS=	48
VIETNAM AVERAGE=	.07	STANDARD DEVIATION=	.0110	NUMBER OF OBSERVATIONS=	14

SYSTEM=OV-1
YVARIABLE= AVERAGE USAGE



WORLDWIDE AVERAGE=	.02	STANDARD DEVIATION=	.0050	NUMBER OF OBSERVATIONS=	65
VIETNAM AVERAGE=	.07	STANDARD DEVIATION=	.0173	NUMBER OF OBSERVATIONS=	29

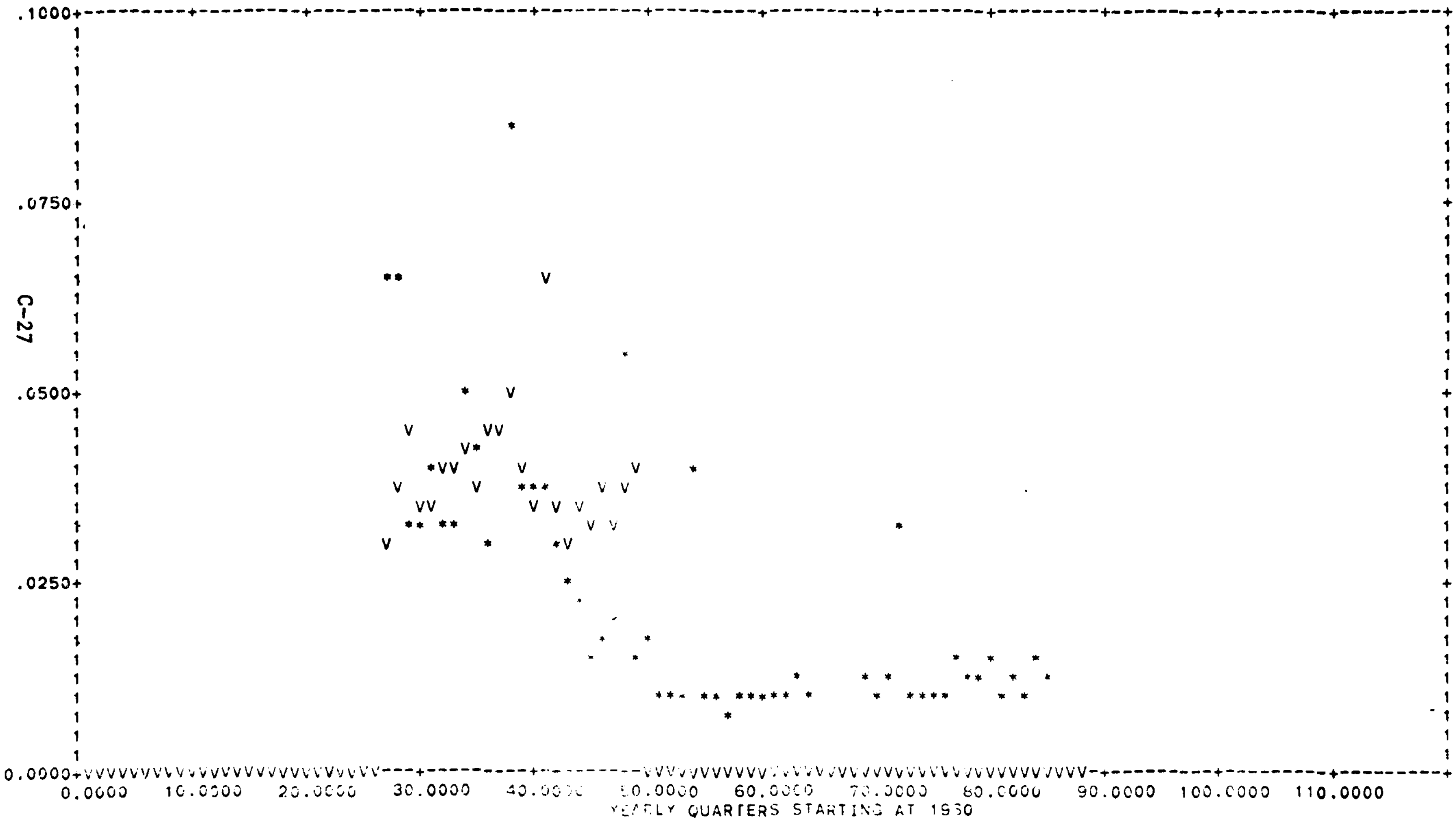
SYSTEM=
YVARIABLE= AVERAGE



WORLDWIDE AVERAGE=	.03	STANDARD DEVIATION=	.0099	NUMBER OF OBSERVATIONS=	65
VIETNAM AVERAGE=	.09	STANDARD DEVIATION=	.0139	NUMBER OF OBSERVATIONS=	30

SYSTEM=AH-1
YVARIABLE=

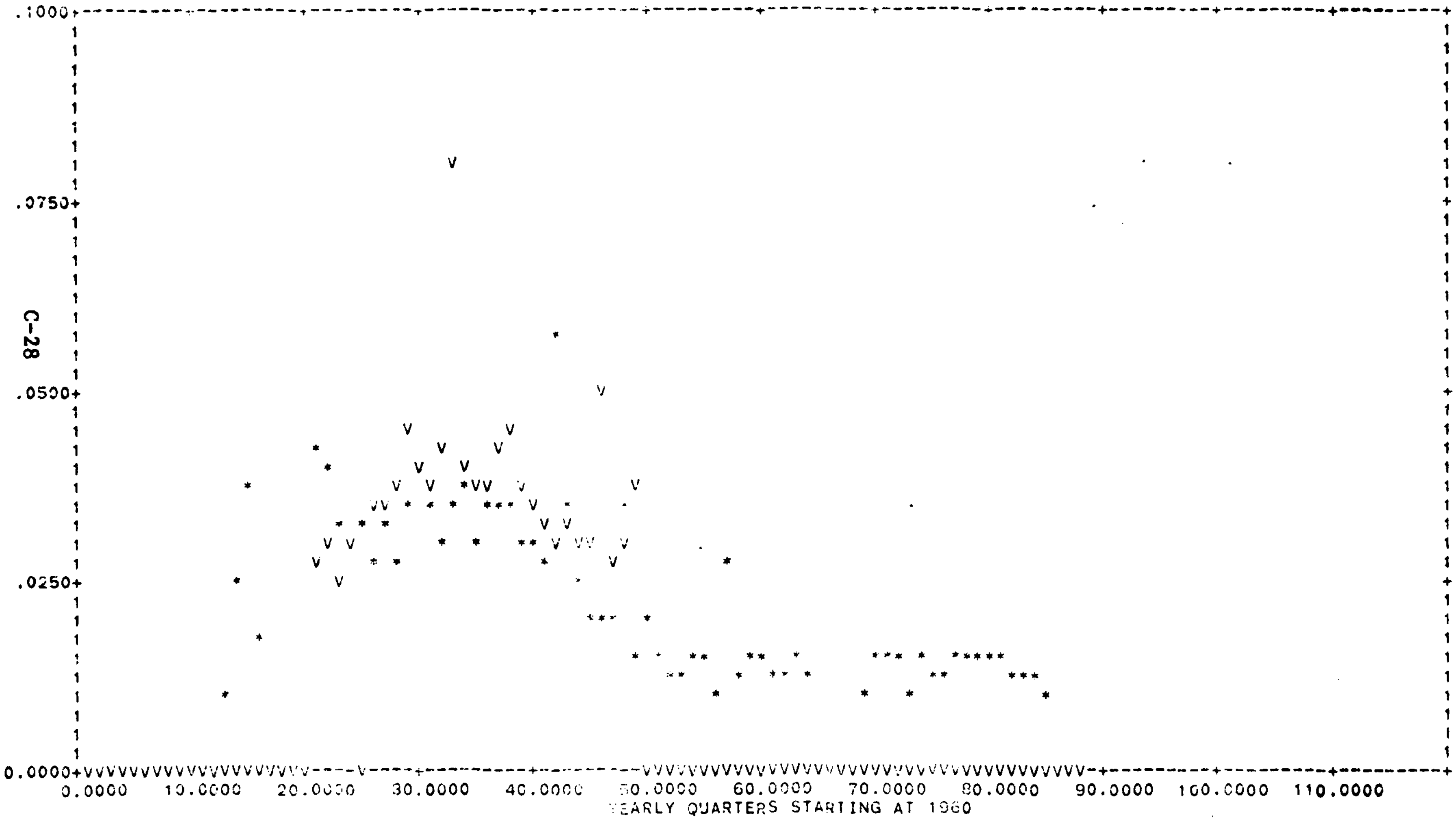
STANDARD DEVIATION OF USAGE



WORLDWIDE AVERAGE= .02 STANDARD DEVIATION= .0172 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= .04 STANDARD DEVIATION= .0073 NUMBER OF OBSERVATIONS= 23

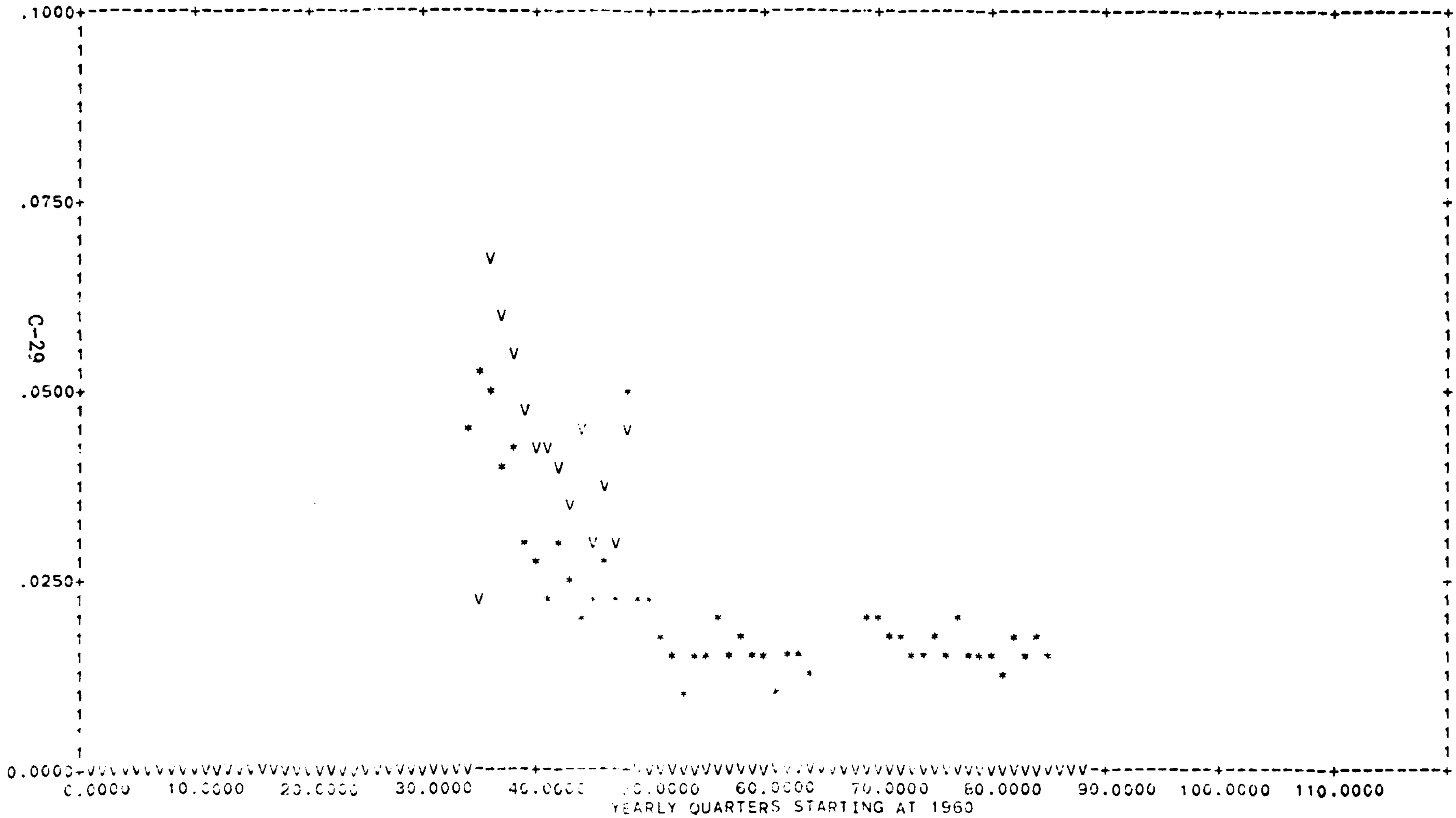
SYSTEM=CH47
YVARIABLE=

STANDARD DEVIATION OF USAGE



WORLDWIDE AVERAGE=	.02	STANDARD DEVIATION=	.0110	NUMBER OF OBSERVATIONS=	66
VIETNAM AVERAGE=	.04	STANDARD DEVIATION=	.0103	NUMBER OF OBSERVATIONS=	28

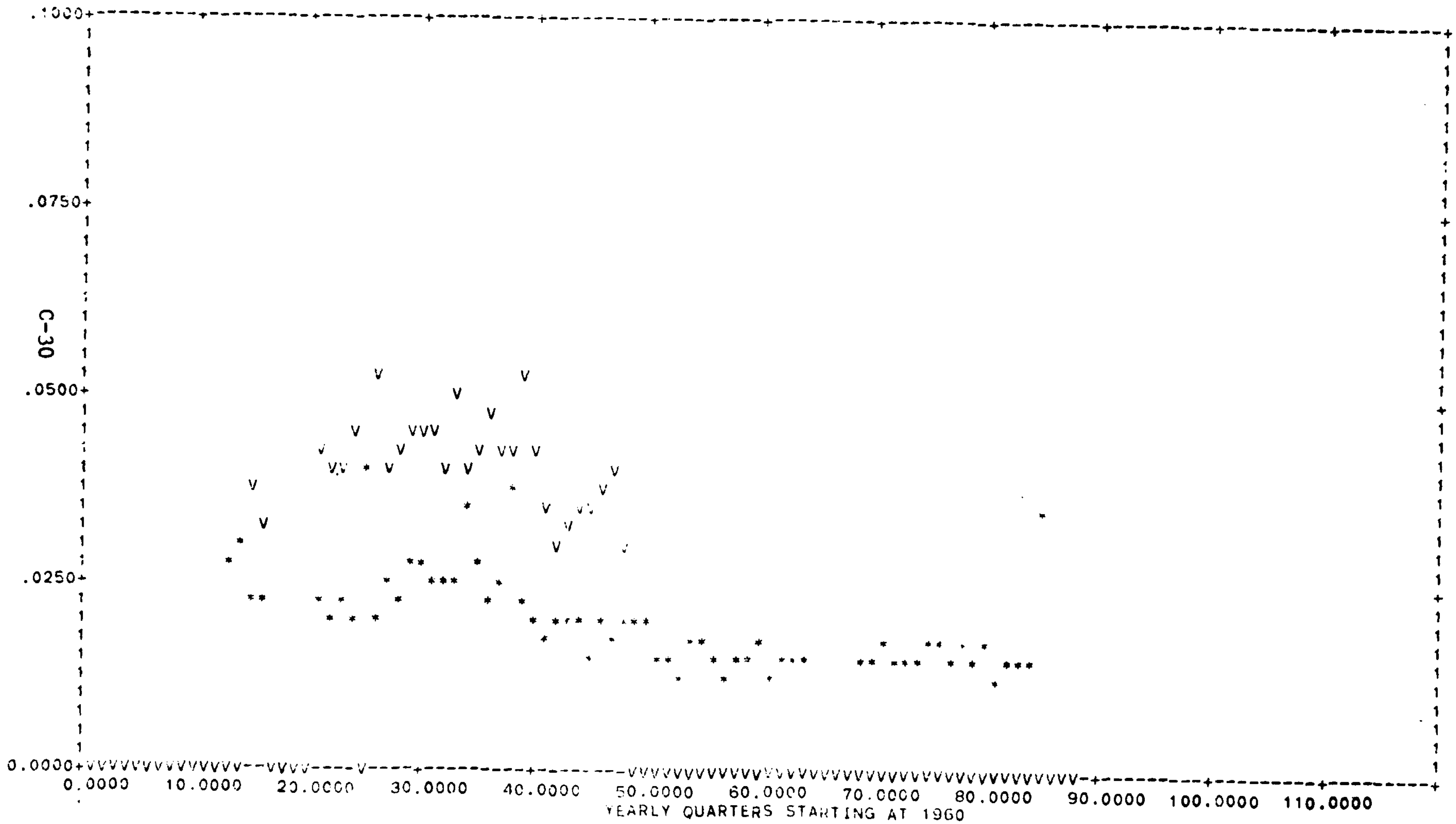
SYSTEM=OH58
YVARIABLE= STANDARD DEVIATION OF USAGE



WORLDWIDE AVERAGE= .02 STANDARD DEVIATION= .0105 NUMBER OF OBSERVATIONS= 48
VIETNAM AVERAGE= .01 STANDARD DEVIATION= .0121 NUMBER OF OBSERVATIONS= 14

SYSTEM=OV-1
YVARIABLE=

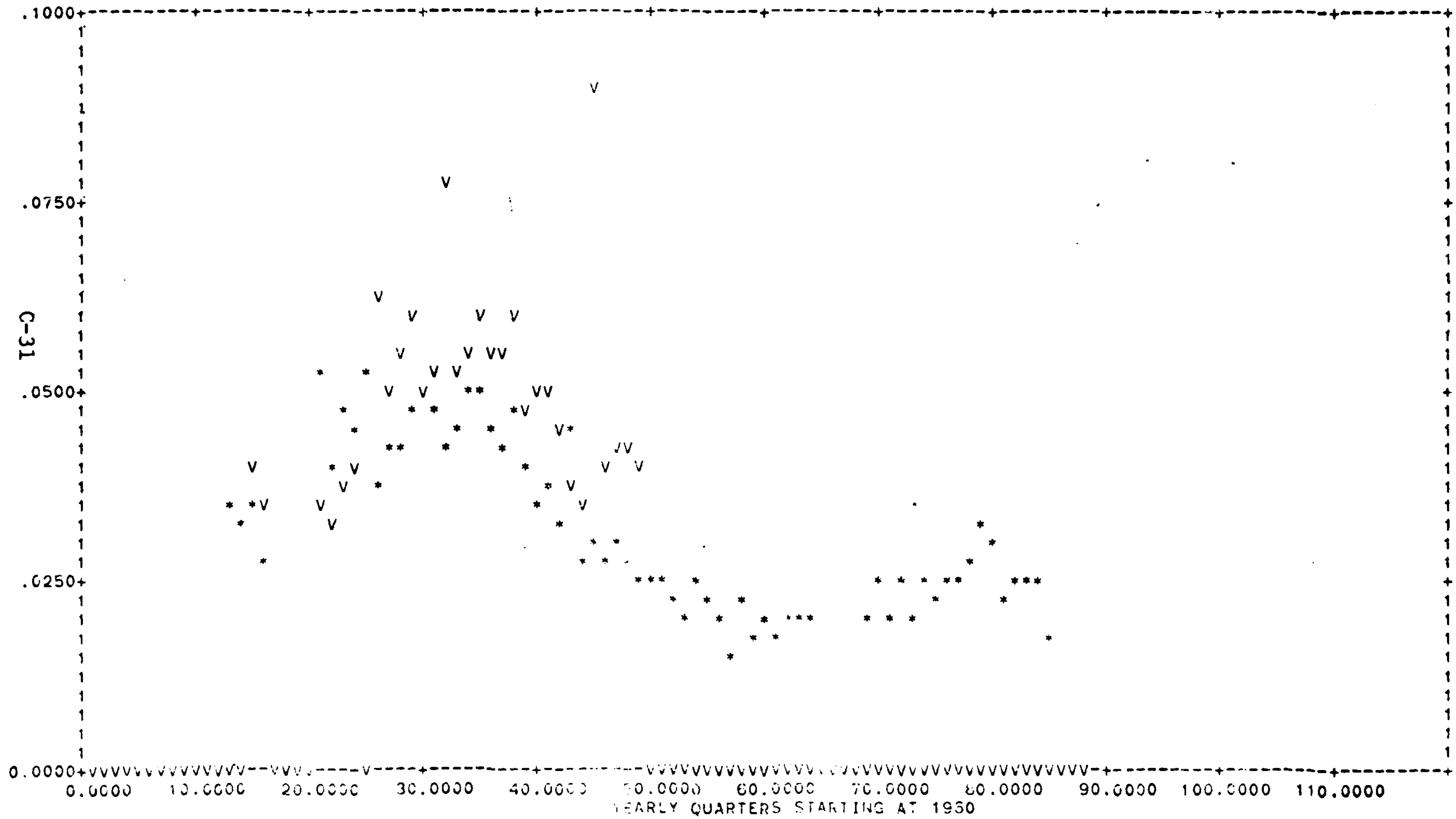
STANDARD DEVIATION OF USAGE



WORLDWIDE AVERAGE=	.02	STANDARD DEVIATION=	.0060	NUMBER OF OBSERVATIONS=	65
VIETNAM AVERAGE=	.04	STANDARD DEVIATION=	.0058	NUMBER OF OBSERVATIONS=	29

SYSTEM=UH-1
YVARIABLE=

STANDARD DEVIATION OF USAGE

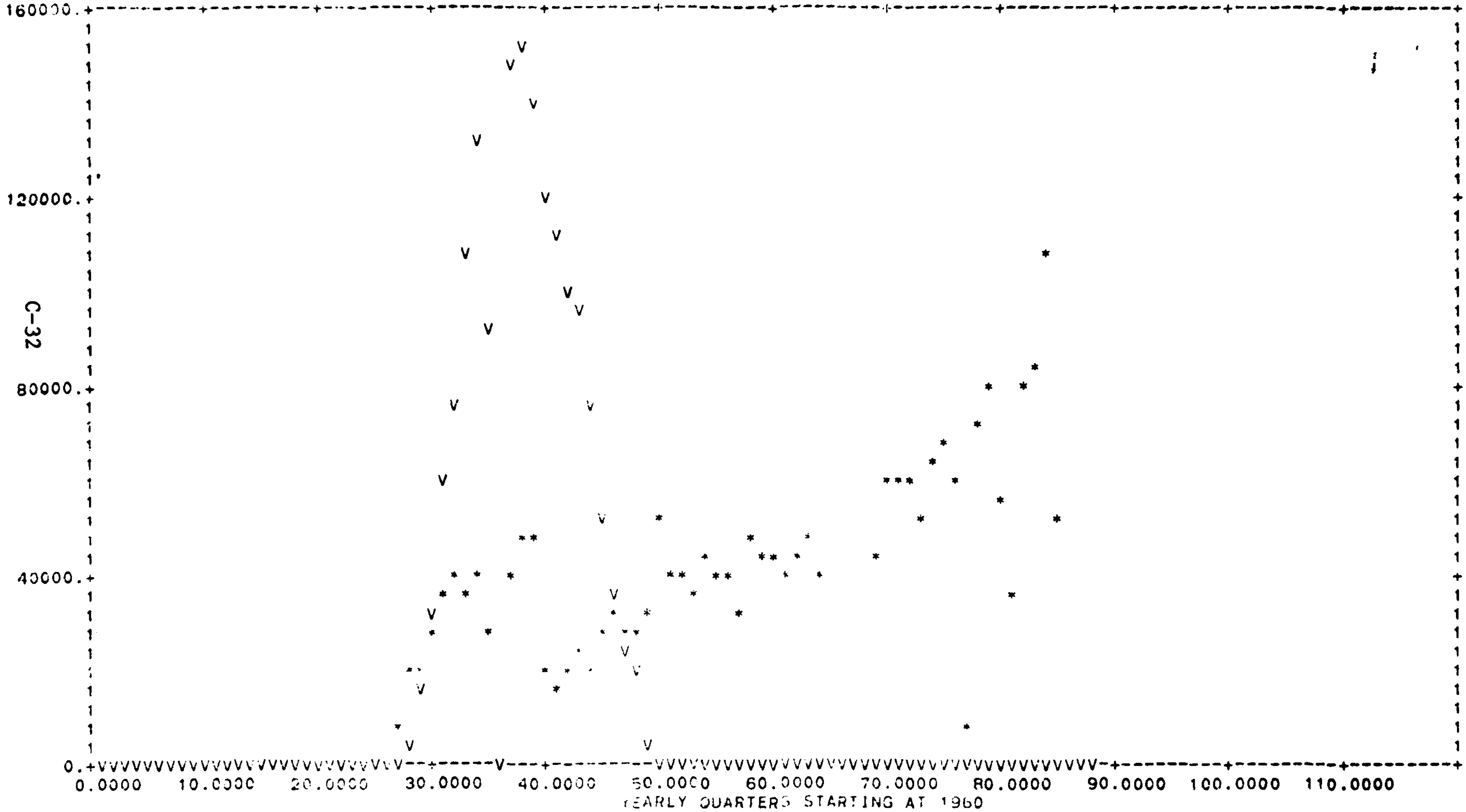


C-31

WORLDWIDE AVERAGE= .03 STANDARD DEVIATION= .0100 NUMBER OF OBSERVATIONS= 65
VIETNAM AVERAGE= .03 STANDARD DEVIATION= .0127 NUMBER OF OBSERVATIONS= 30

SYSTEM=AH-1
YVARIABLE=

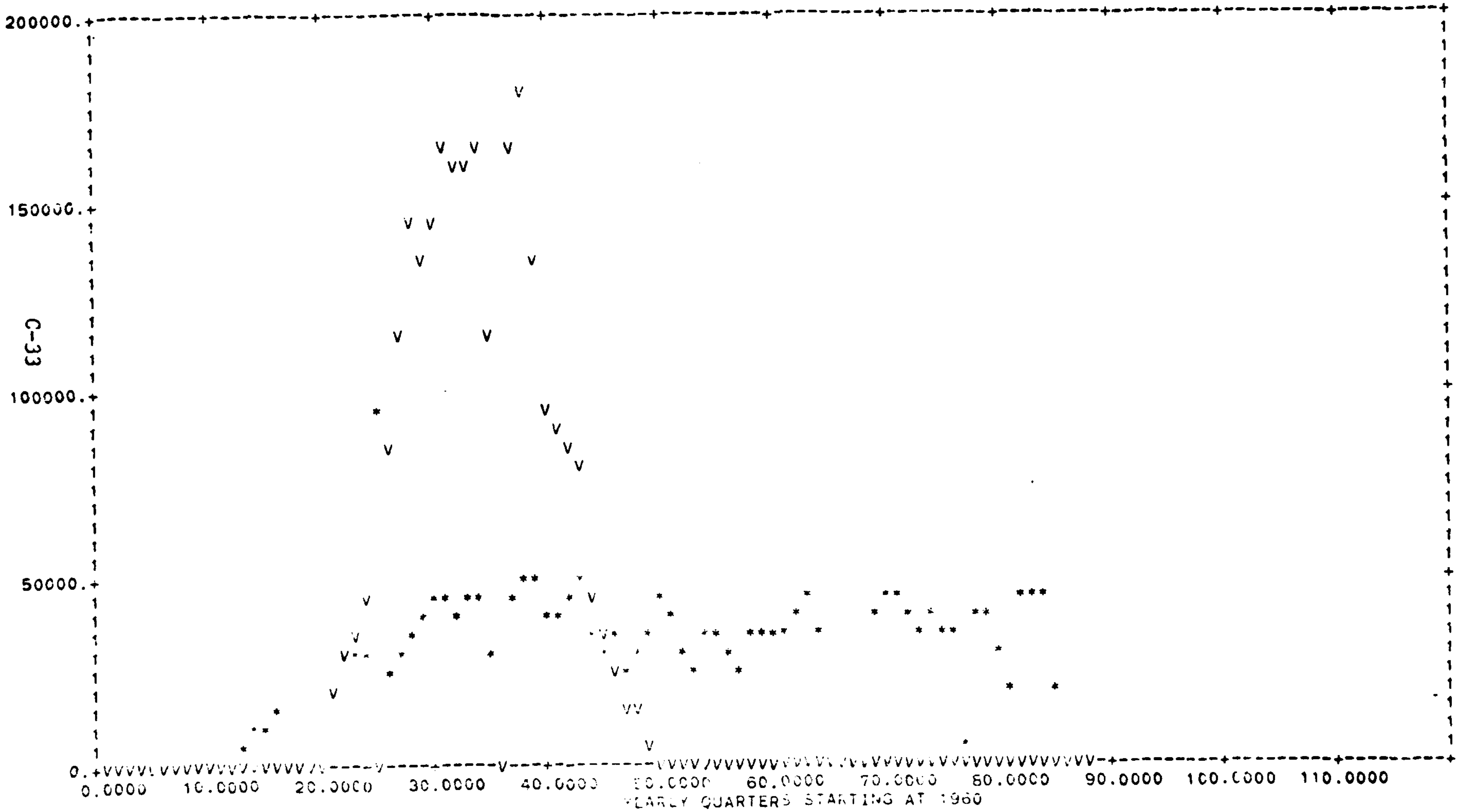
TOTAL NUMBER OF SORTIES



WORLDWIDE AVERAGE=	41972.56	STANDARD DEVIATION=	20104.9462	NUMBER OF OBSERVATIONS=	55
VIETNAM AVERAGE=	72526.50	STANDARD DEVIATION=	50350.0678	NUMBER OF OBSERVATIONS=	22

SYSTEM=CH47
YVARIABLE=

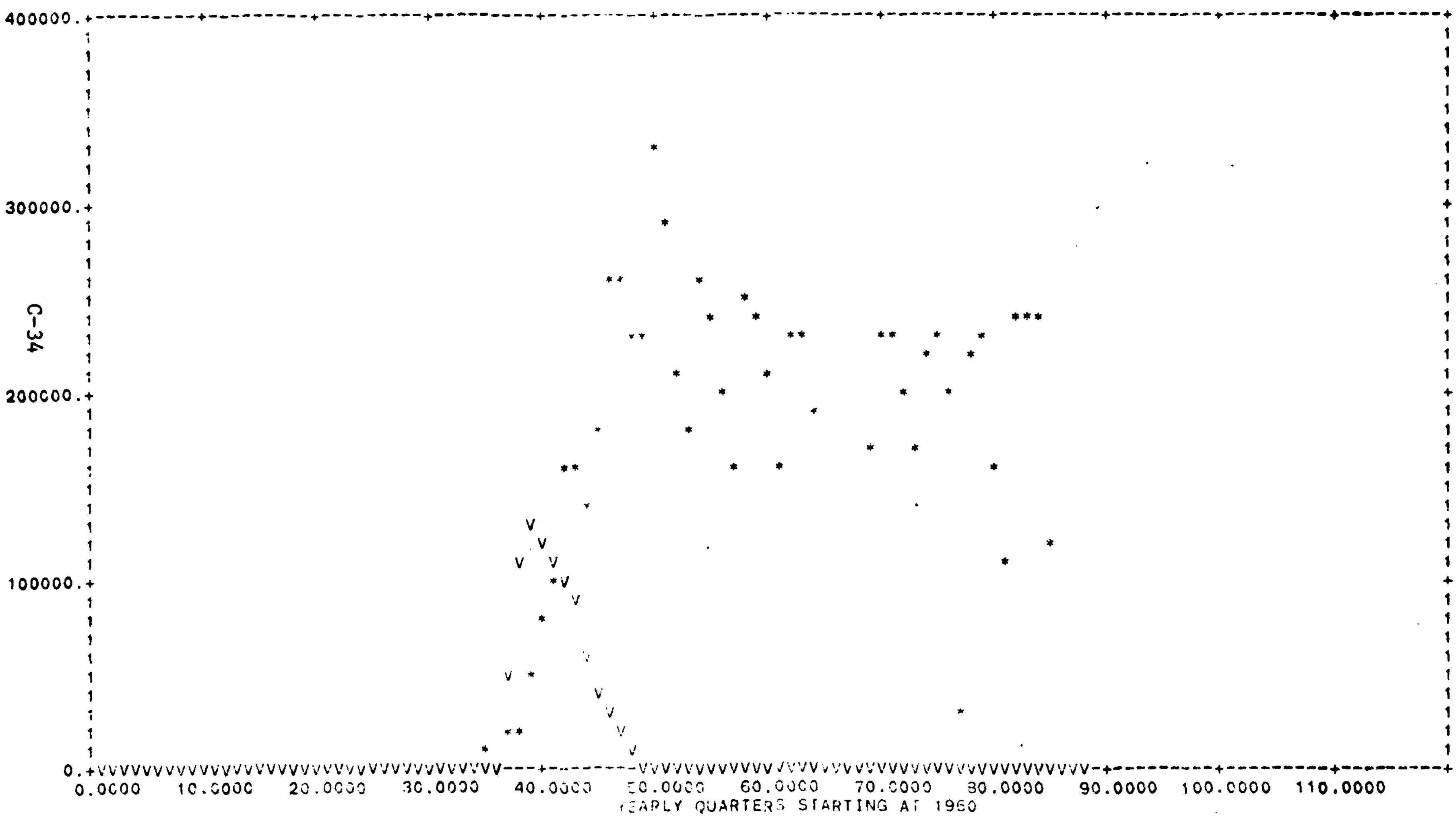
TOTAL NUMBER OF SORTIES



WORLDWIDE AVERAGE= 35263.75 STANDARD DEVIATION= 12849.8646 NUMBER OF OBSERVATIONS= 64
VIETNAM AVERAGE= 92423.11 STANDARD DEVIATION= 58184.6638 NUMBER OF OBSERVATIONS= 27

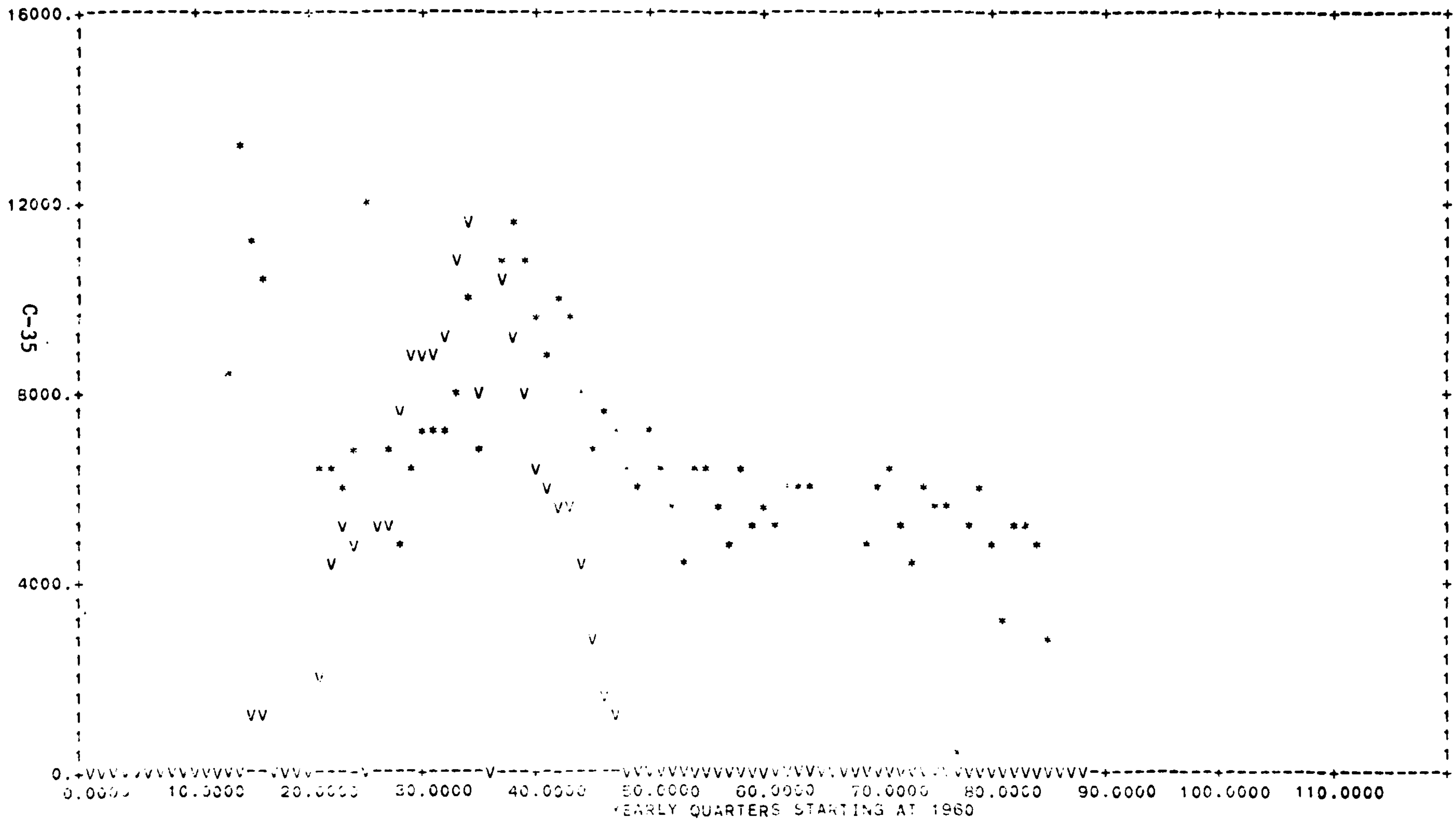
SYSTEM-CH53
YVARIABLE=

TOTAL NUMBER OF SORTIES



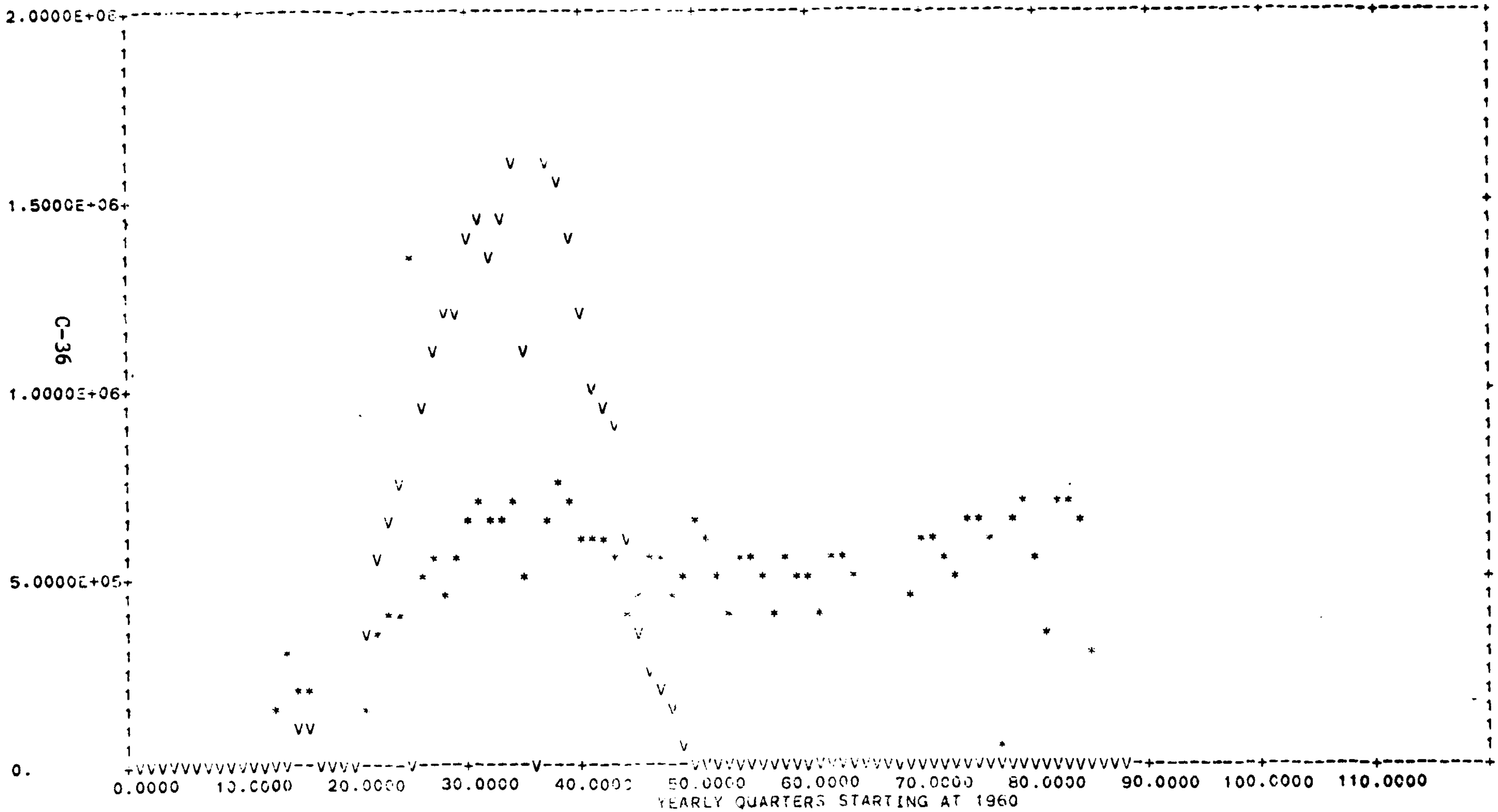
WORLDWIDE AVERAGE=	180843.79	STANDARD DEVIATION=	78536.4151	NUMBER OF OBSERVATIONS=	47
VIETNAM AVERAGE=	66556.77	STANDARD DEVIATION=	45214.7484	NUMBER OF OBSERVATIONS=	13

SYSTEM=OV-1
YVARIABLE= TOTAL NUMBER OF SORTIES



WORLDWIDE AVERAGE=	6568.18	STANDARD DEVIATION=	2550.2021	NUMBER OF OBSERVATIONS=	66
VIETNAM AVERAGE=	5874.57	STANDARD DEVIATION=	3291.8869	NUMBER OF OBSERVATIONS=	28

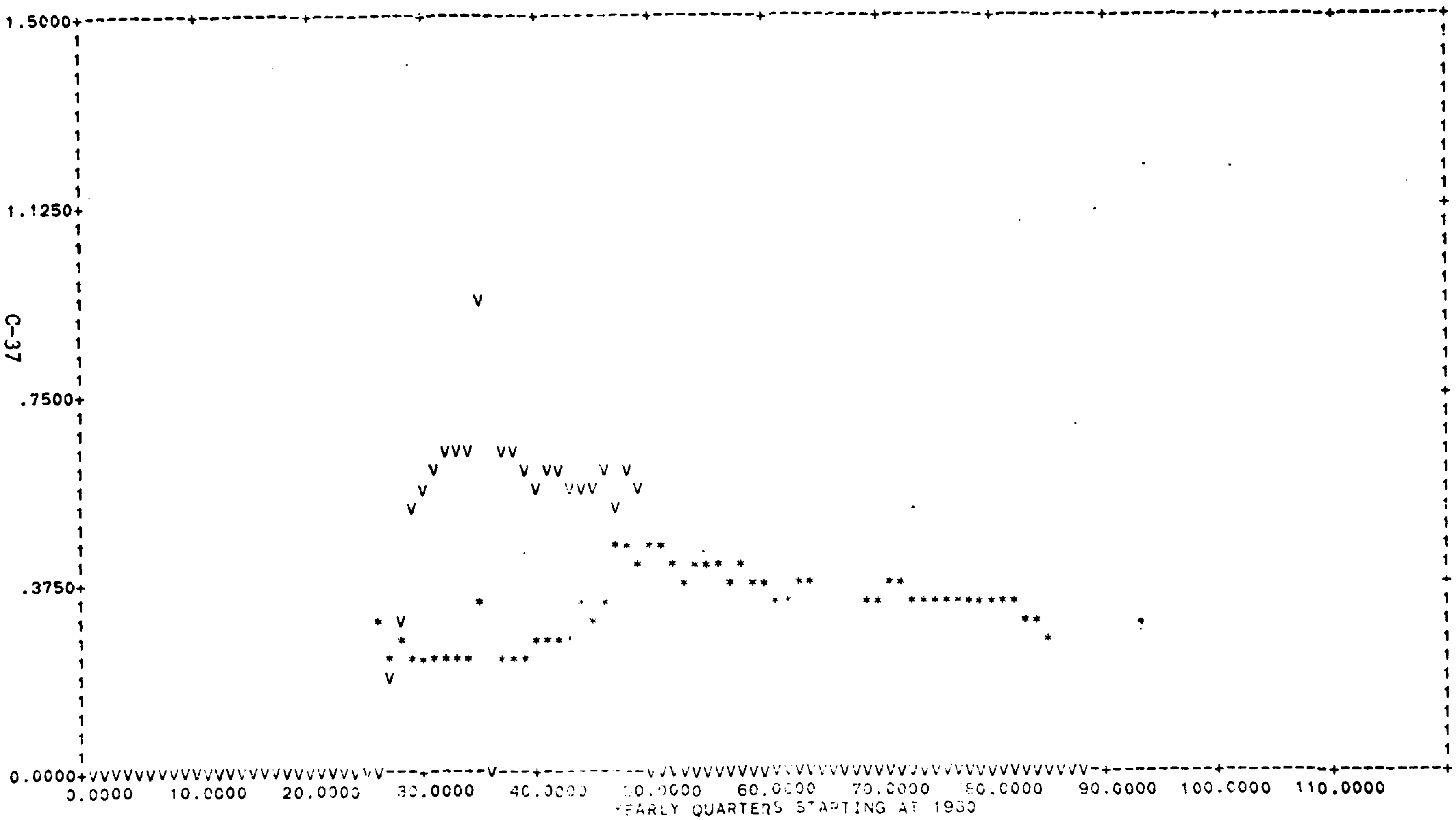
SYSTEM=UH-1
YVARIABLE= TOTAL NUMBER OF SORTIES



WORLDWIDE AVERAGE=	486193.52	STANDARD DEVIATION=	222193.6360	NUMBER OF OBSERVATIONS=	69
VIETNAM AVERAGE=	879062.14	STANDARD DEVIATION=	515704.9097	NUMBER OF OBSERVATIONS=	29

SYSTEM=AH-1
YVARIABLE=

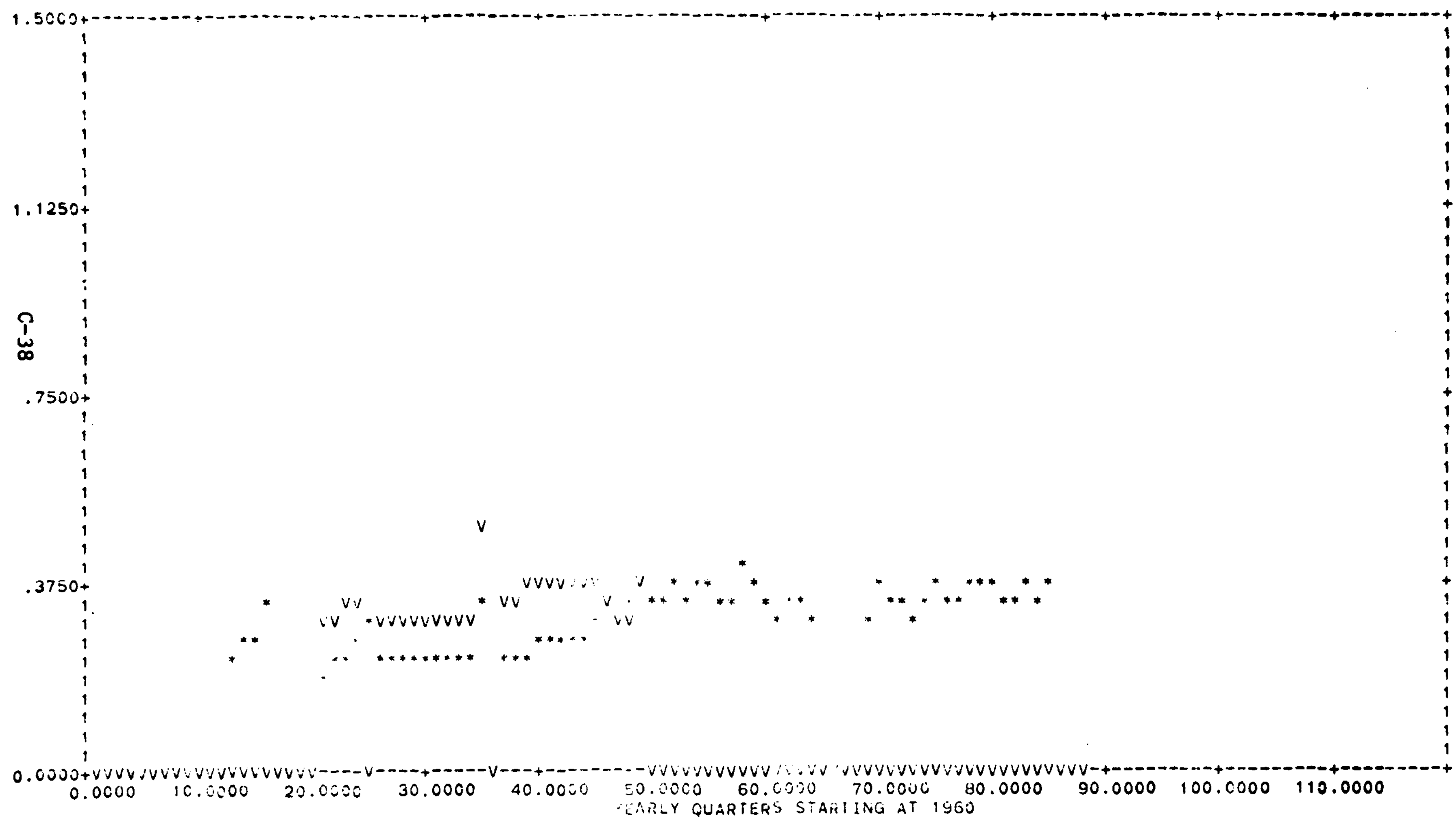
AVERAGE LENGTH OF SORTIES



WORLDWIDE AVERAGE= .33 STANDARD DEVIATION= .[illegible]670 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= .57 STANDARD DEVIATION= .1340 NUMBER OF OBSERVATIONS= 22

SYSTEM-CH47
YVARIABLE=

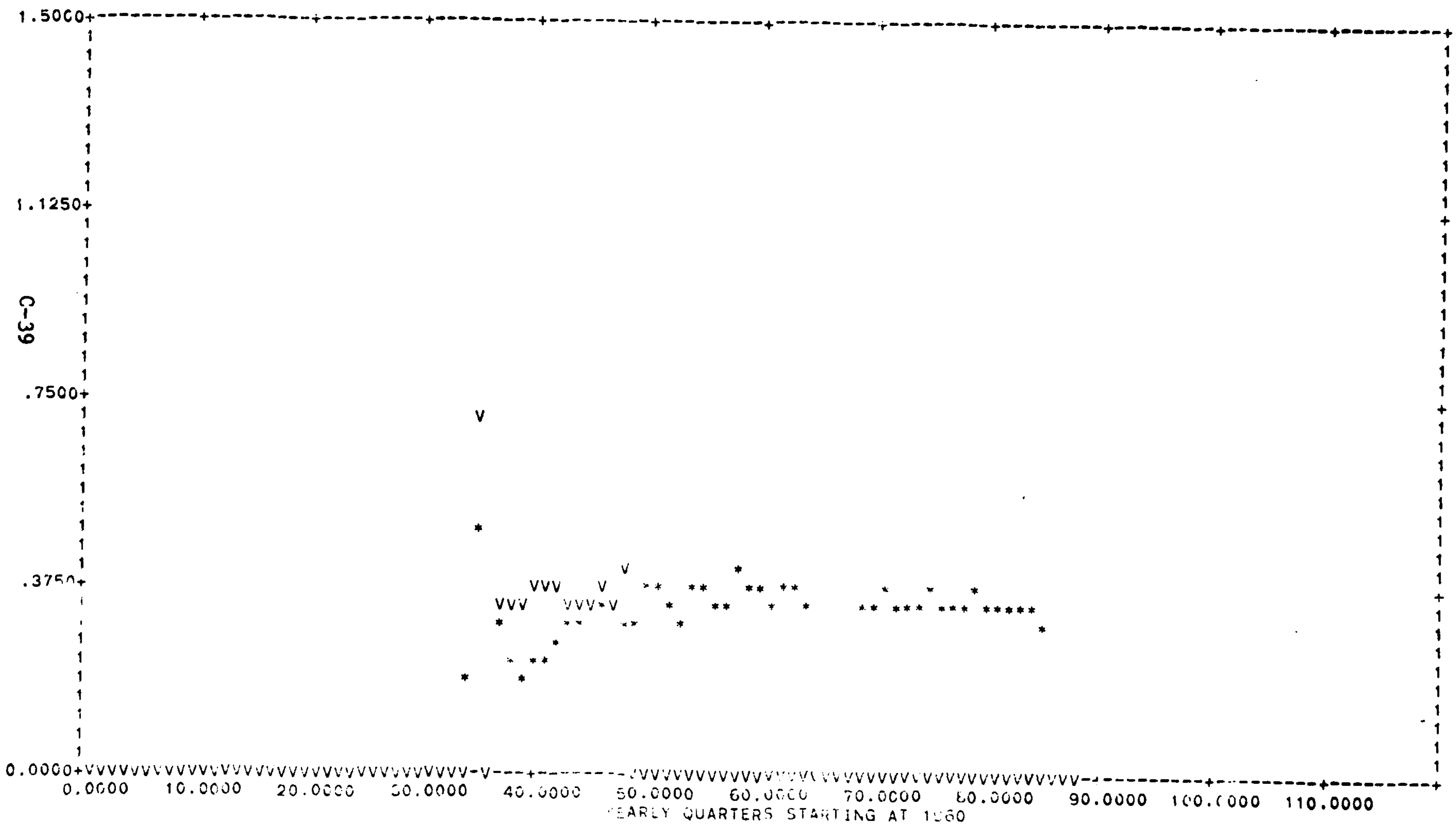
AVERAGE LENGTH OF SORTIES



WORLDWIDE AVERAGE=	.30	STANDARD DEVIATION=	.0531	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.34	STANDARD DEVIATION=	.0412	NUMBER OF OBSERVATIONS=	27

SYSTEM=OH58
YVARIABLE=

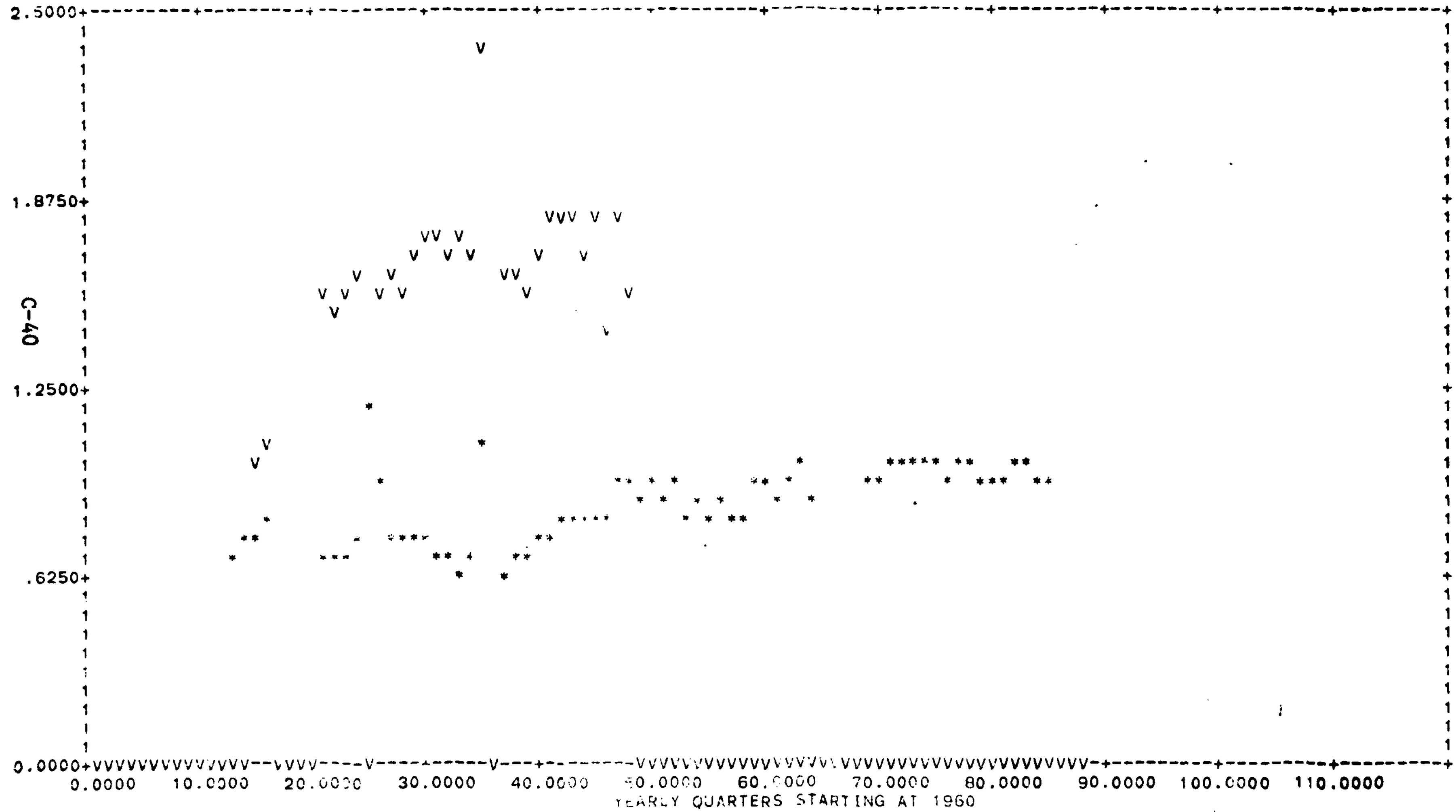
AVERAGE LENGTH OF SORTIES



WORLDWIDE AVERAGE=	.33	STANDARD DEVIATION=	.0528	NUMBER OF OBSERVATIONS=	47
VIETNAM AVERAGE=	.38	STANDARD DEVIATION=	.1004	NUMBER OF OBSERVATIONS=	13

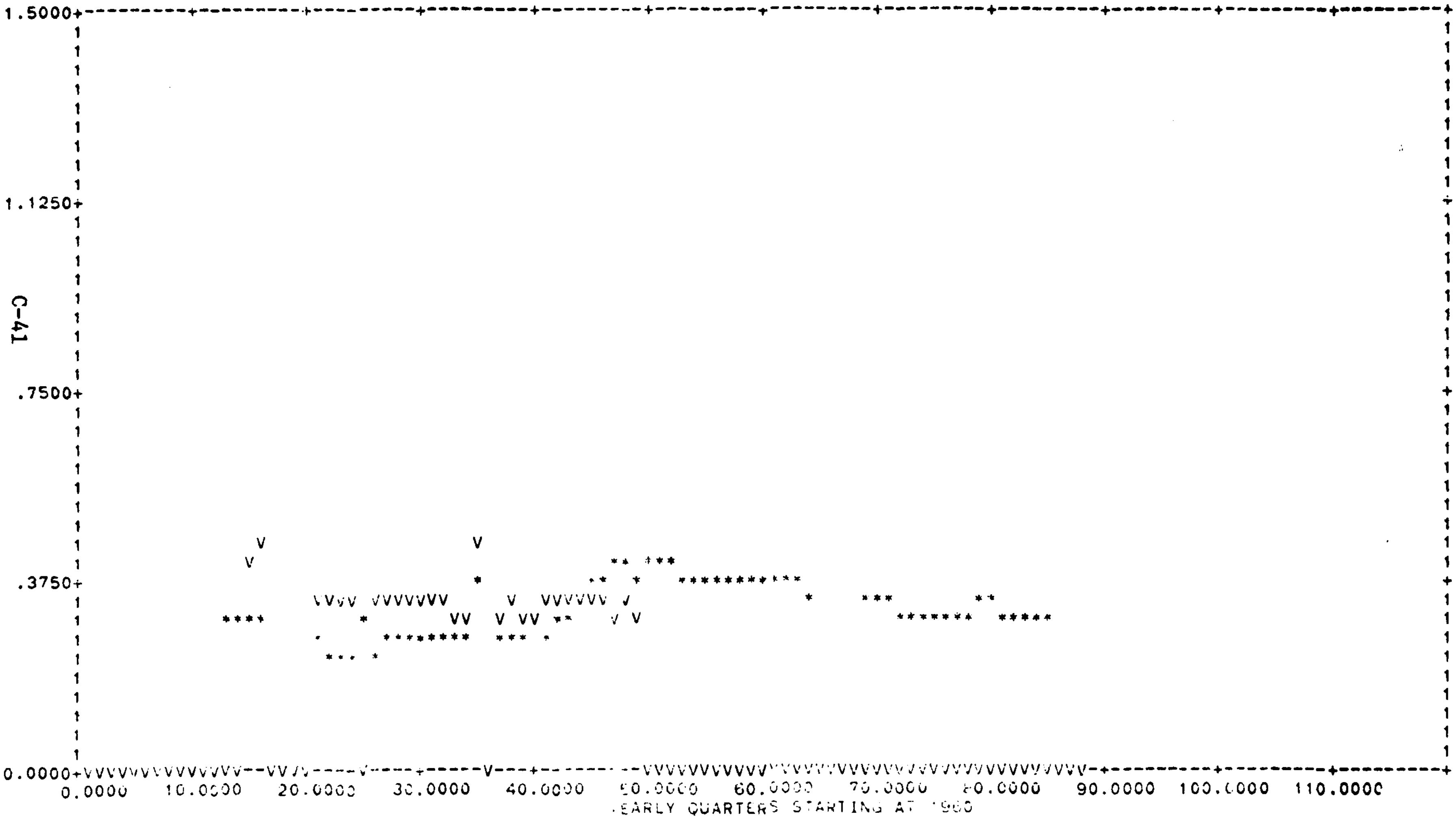
SYSTEM=OV-1
YVARIABLE=

AVERAGE LENGTH OF SORTIES



WORLDWIDE AVERAGE=	.86	STANDARD DEVIATION=	.1215	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	1.65	STANDARD DEVIATION=	.2393	NUMBER OF OBSERVATIONS=	28

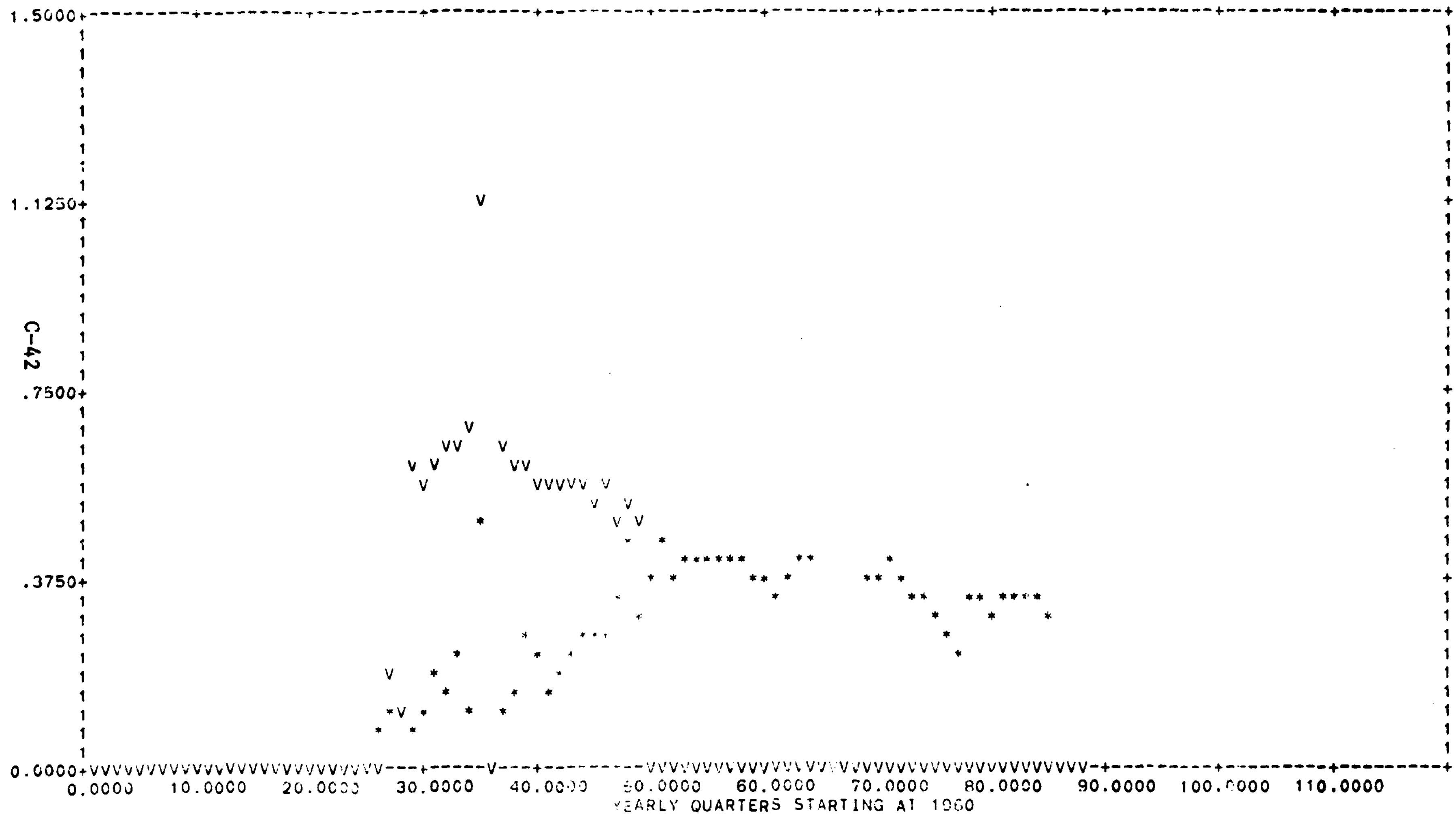
SYSTEM=UH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES



WORLDWIDE AVERAGE=	.32	STANDARD DEVIATION=	.0525	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.34	STANDARD DEVIATION=	.0460	NUMBER OF OBSERVATIONS=	29

SYSTEM=AC-1
YVARIABLE=

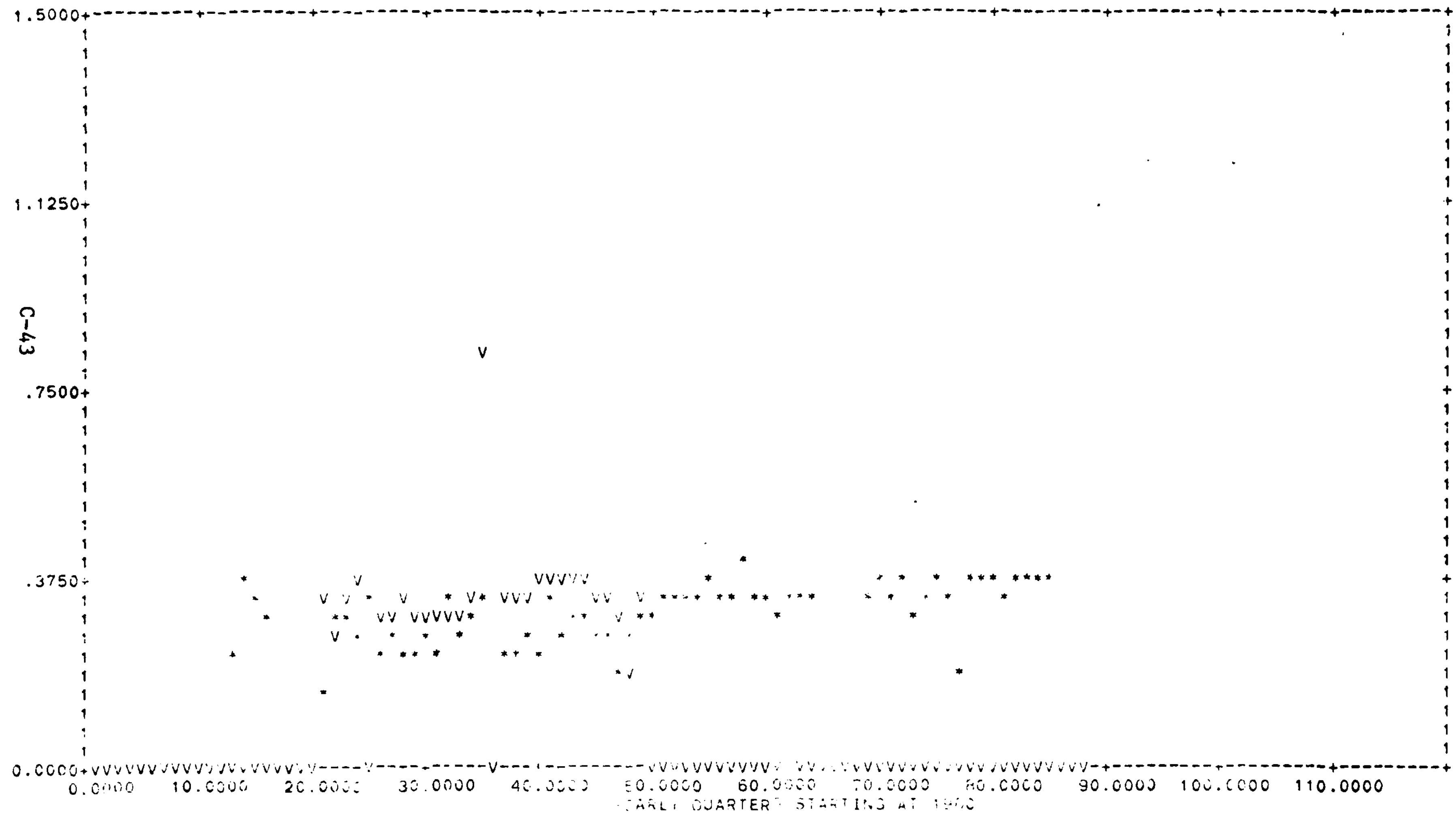
AVERAGE LENGTH OF SORTIES BY AIRCRAFT



WORLDWIDE AVERAGE= .30 STANDARD DEVIATION= .1079 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= .56 STANDARD DEVIATION= .1341 NUMBER OF OBSERVATIONS= 22

SYSTEM=CH47
YVARIABLE=

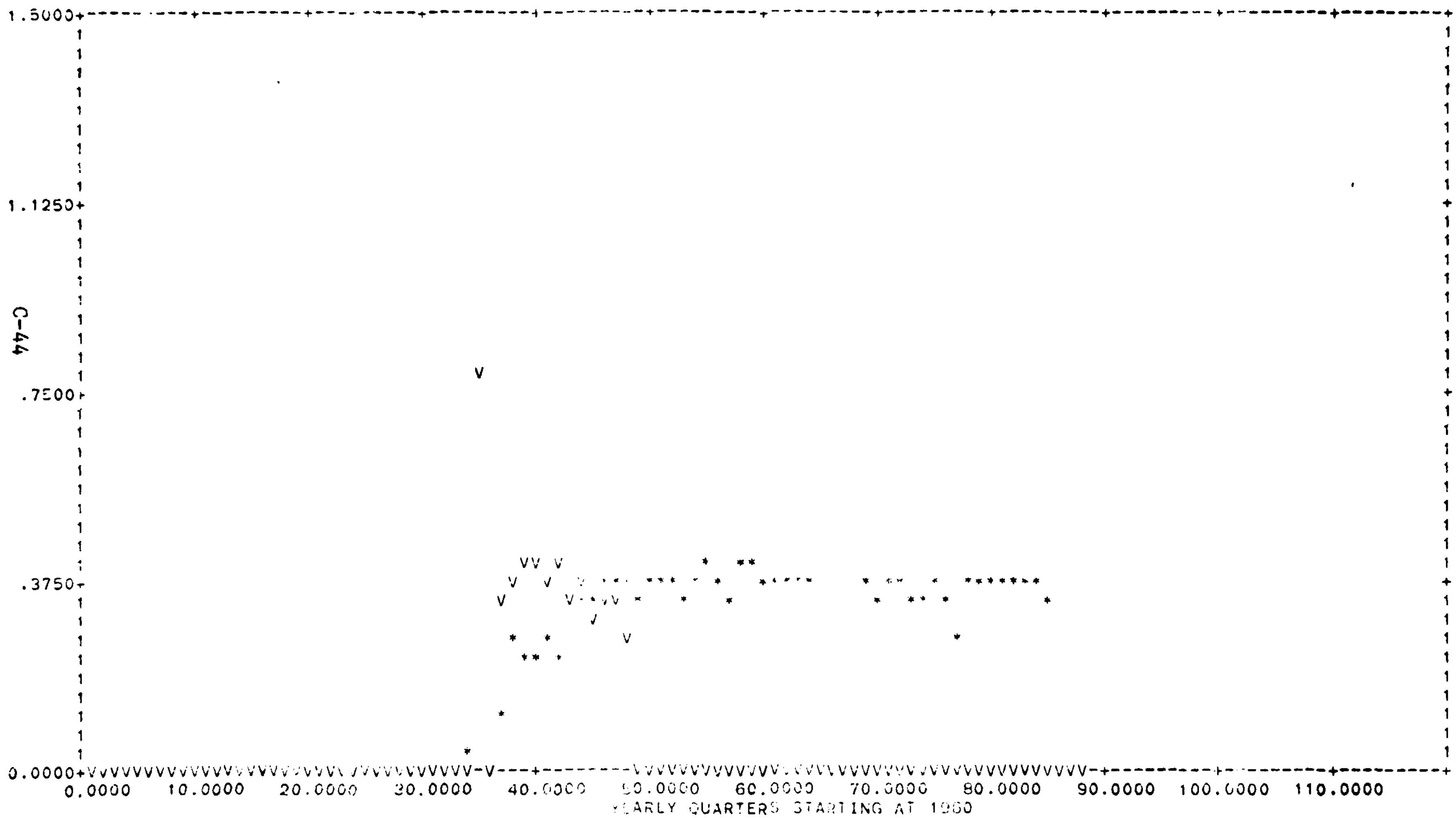
AVERAGE LENGTH OF SORTIES BY AIRCRAFT



WORLDWIDE AVERAGE= .31 STANDARD DEVIATION= .05[illegible] NUMBER OF OBSERVATIONS= 64
VIETNAM AVERAGE= .3[illegible] STANDARD DEVIATION= .1[illegible] NUMBER OF OBSERVATIONS= 27

SYSTEM-0958
YVARIABLE-

AVERAGE LENGTH OF SORTIES BY AIRCRAFT

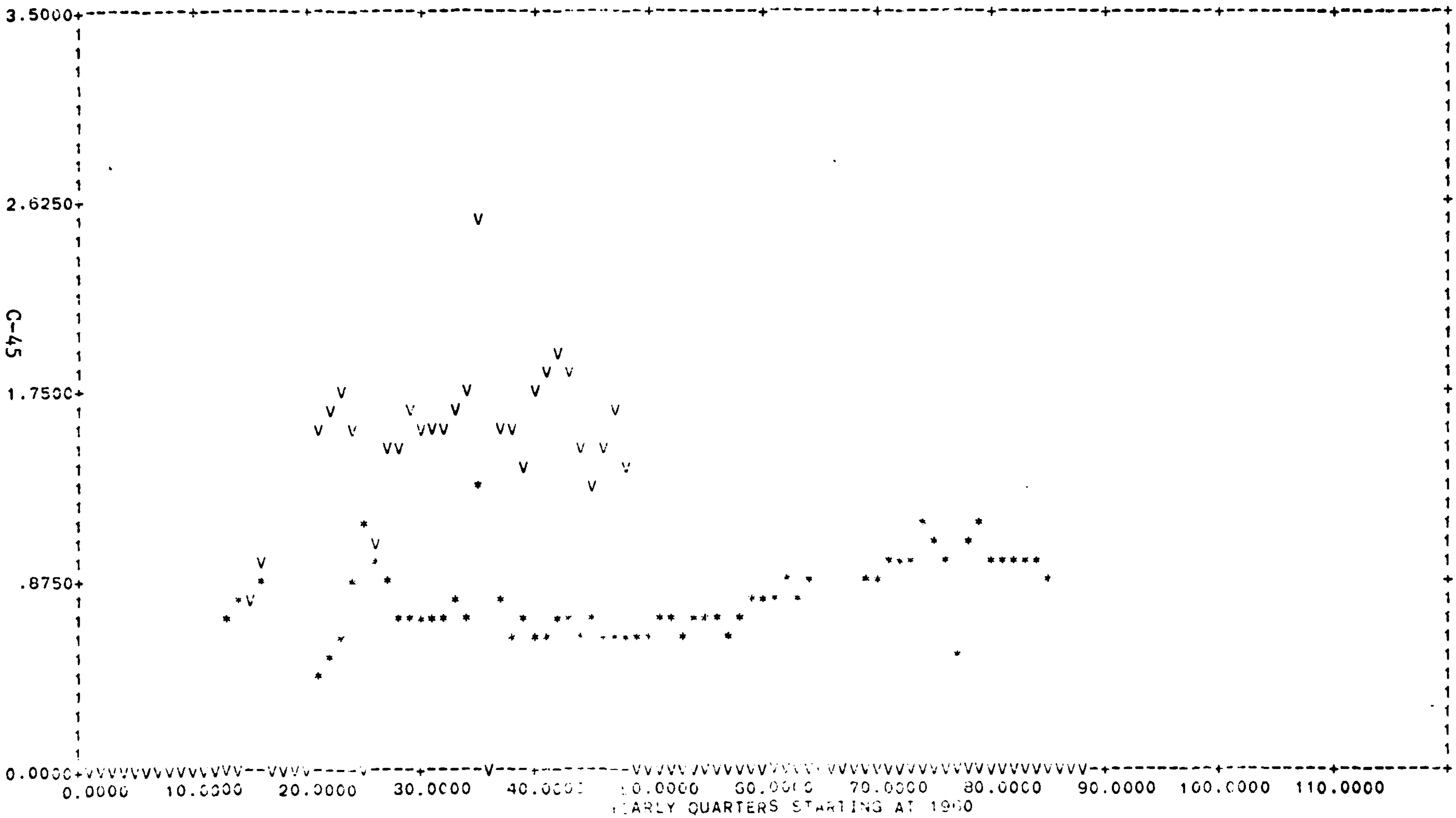


WORLDWIDE AVERAGE=	.37	STANDARD DEVIATION=	.2608	NUMBER OF OBSERVATIONS=	47
VIETNAM AVERAGE=	.33	STANDARD DEVIATION=	[illegible]	NUMBER OF OBSERVATIONS=	13

GRAFH-OUTLIER · AT 35. YVALUE= 2.055

SYSTEM=OV-1
YVARIABLE=

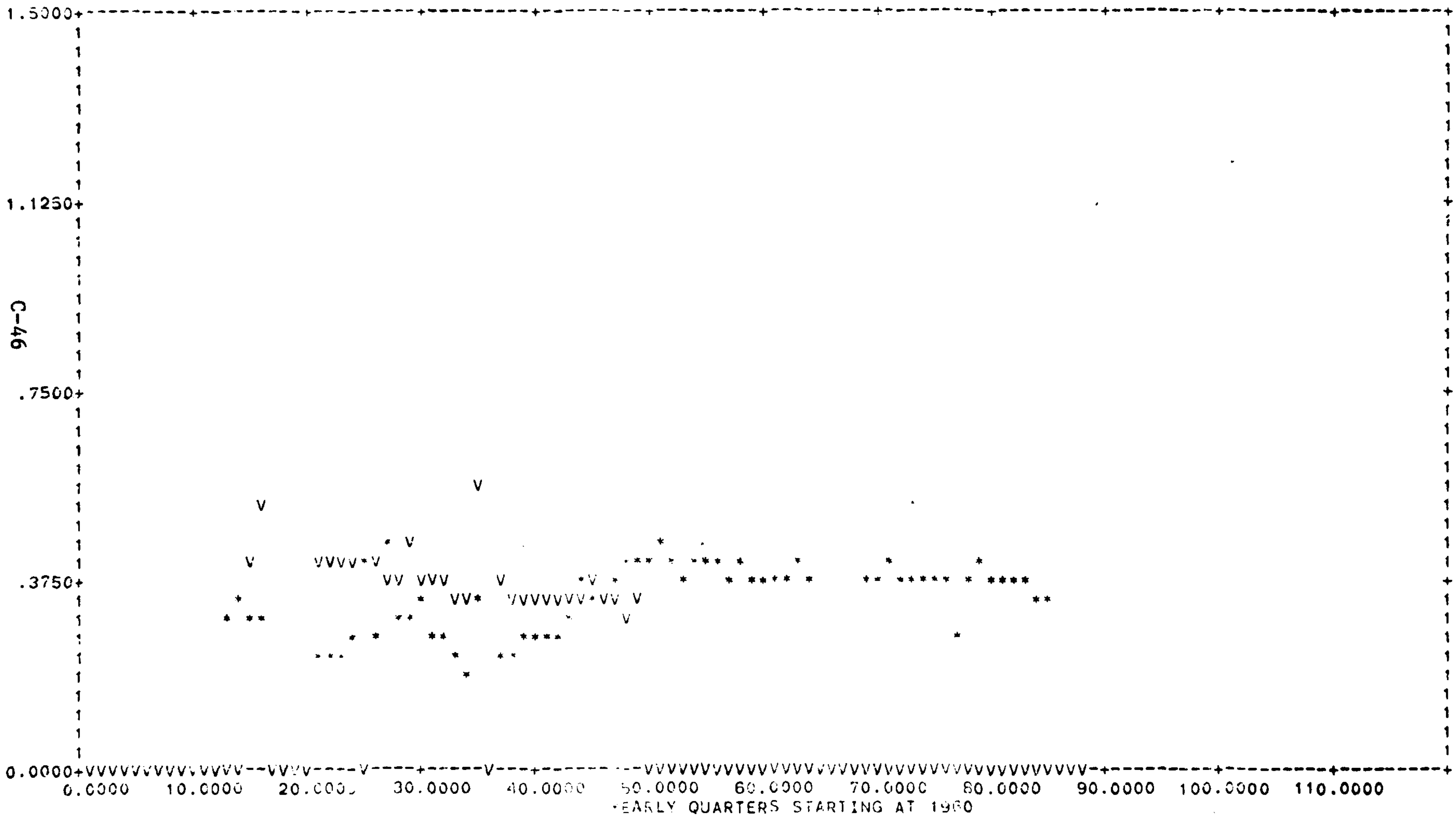
AVERAGE LENGTH OF SORTIES BY AIRCRAFT



WORLDWIDE AVERAGE= .79 STANDARD DEVIATION= .1705 NUMBER OF OBSERVATIONS= 64
VIETNAM AVERAGE= 1.56 STANDARD DEVIATION= .3102 NUMBER OF OBSERVATIONS= 28

SYSTEM=UH-1
YVARIABLE=

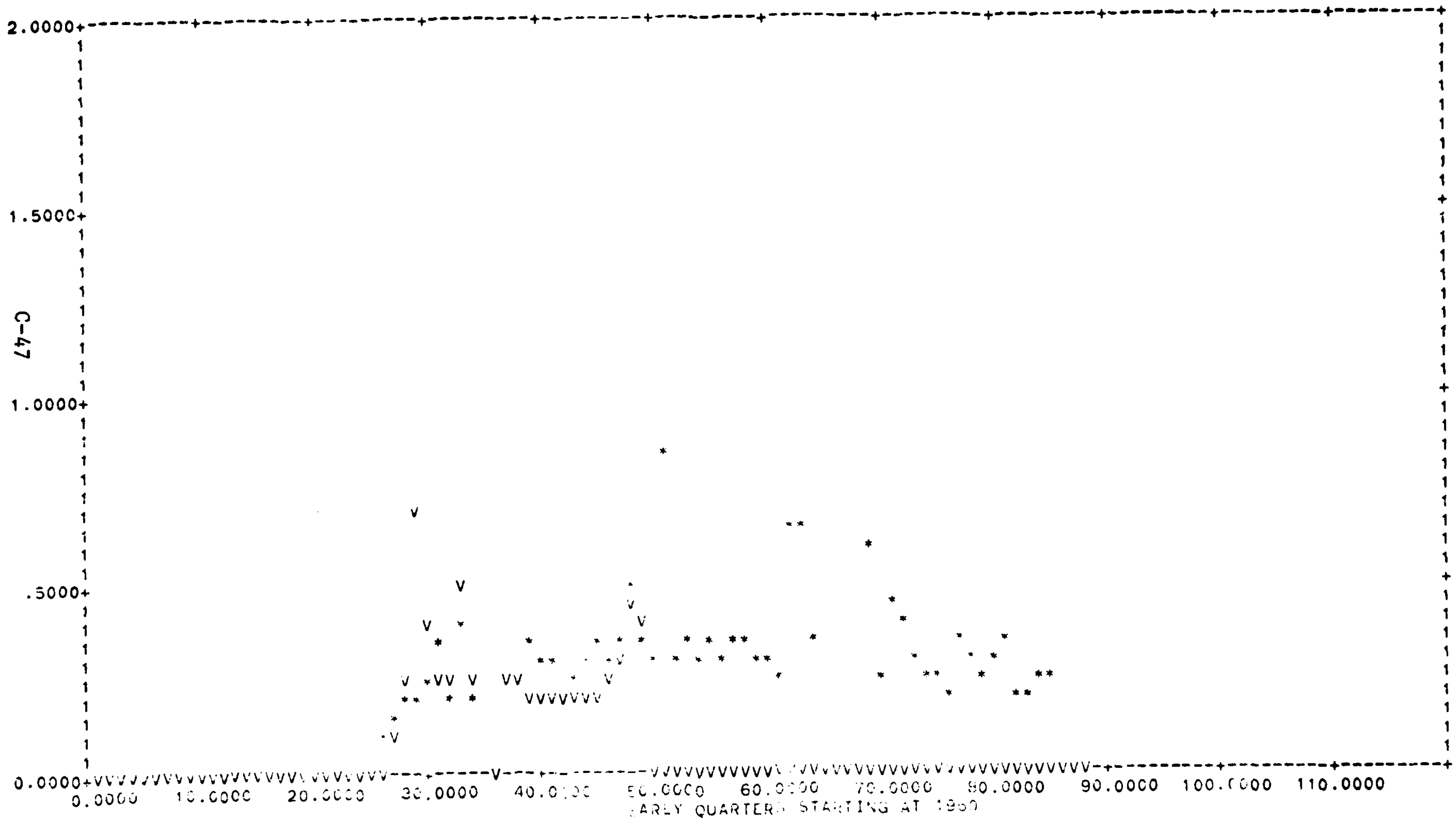
AVERAGE LENGTH OF SORTIES BY AIRCRAFT



WORLDWIDE AVERAGE=	.34	STANDARD DEVIATION=	.0576	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.38	STANDARD DEVIATION=	.0562	NUMBER OF OBSERVATIONS=	29

SYSTEM=AH-1
YVARIABLE=

STANDARD DEVIATION OF LENGTH OF SORTIE BY AIRCRAFT

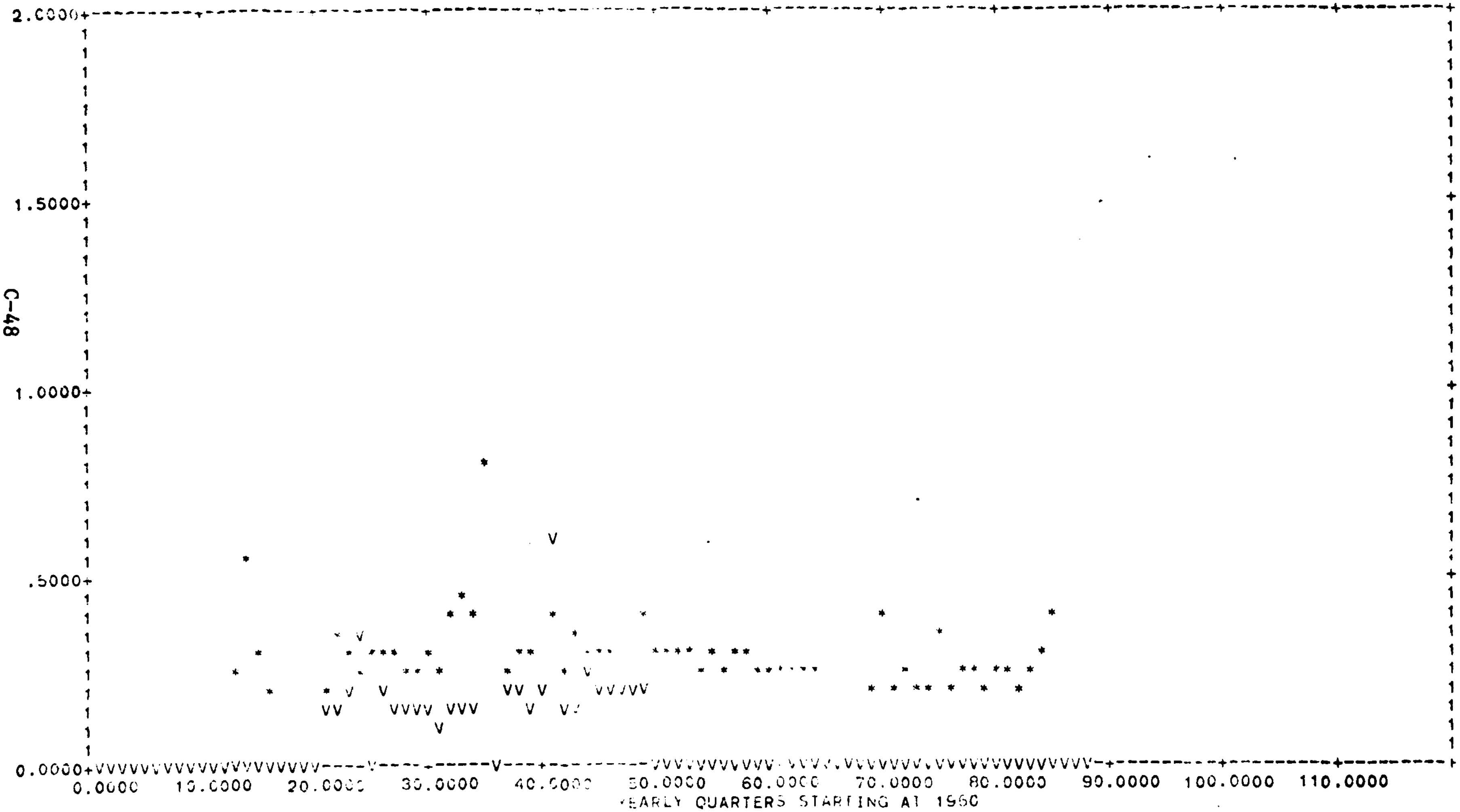


WORLDWIDE AVERAGE= .37 STANDARD DEVIATION= .4410 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= .38 STANDARD DEVIATION= .4728 NUMBER OF OBSERVATIONS= 22

GRAPH-OUTLIER * AT 25. YVALUE= 3.446
GRAPH-OUTLIER V AT 25. YVALUE= 2.421

SYSTEM=CH-?
YVARIABLE=

STANDARD DEVIATION OF LENGTH OF SORTIE BY AIRCRAFT

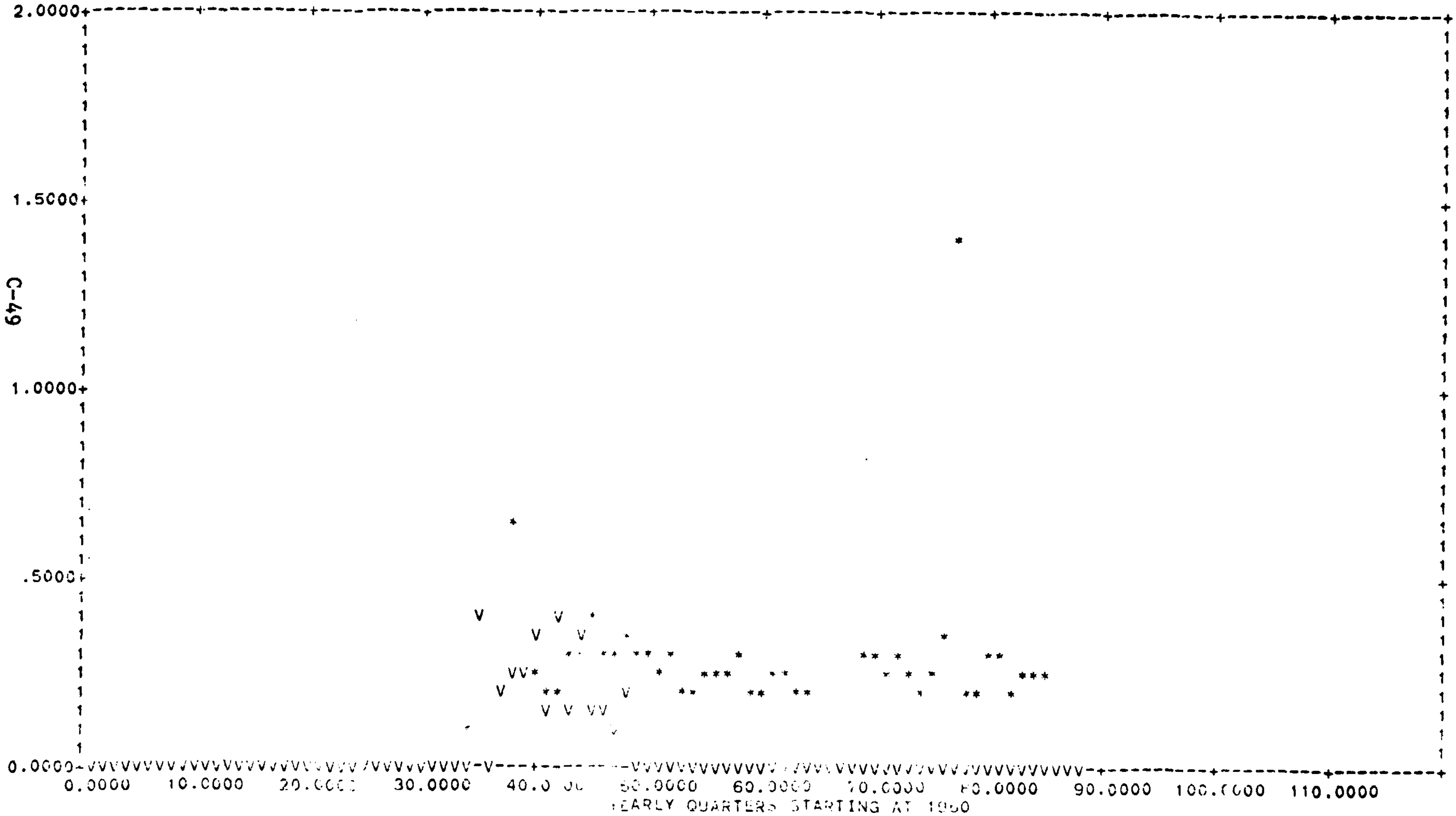


WORLDWIDE AVERAGE=	.29	STANDARD DEVIATION=	.0918	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.39	STANDARD DEVIATION=	.0986	NUMBER OF OBSERVATIONS=	27

GRAPH-OUTLIER V AT 35. YVALUE= 5.31

SYSTEM=OH58
YVARIABLE=

STANDARD DEVIATION OF LENGTH OF SORTIE BY AIRCRAFT

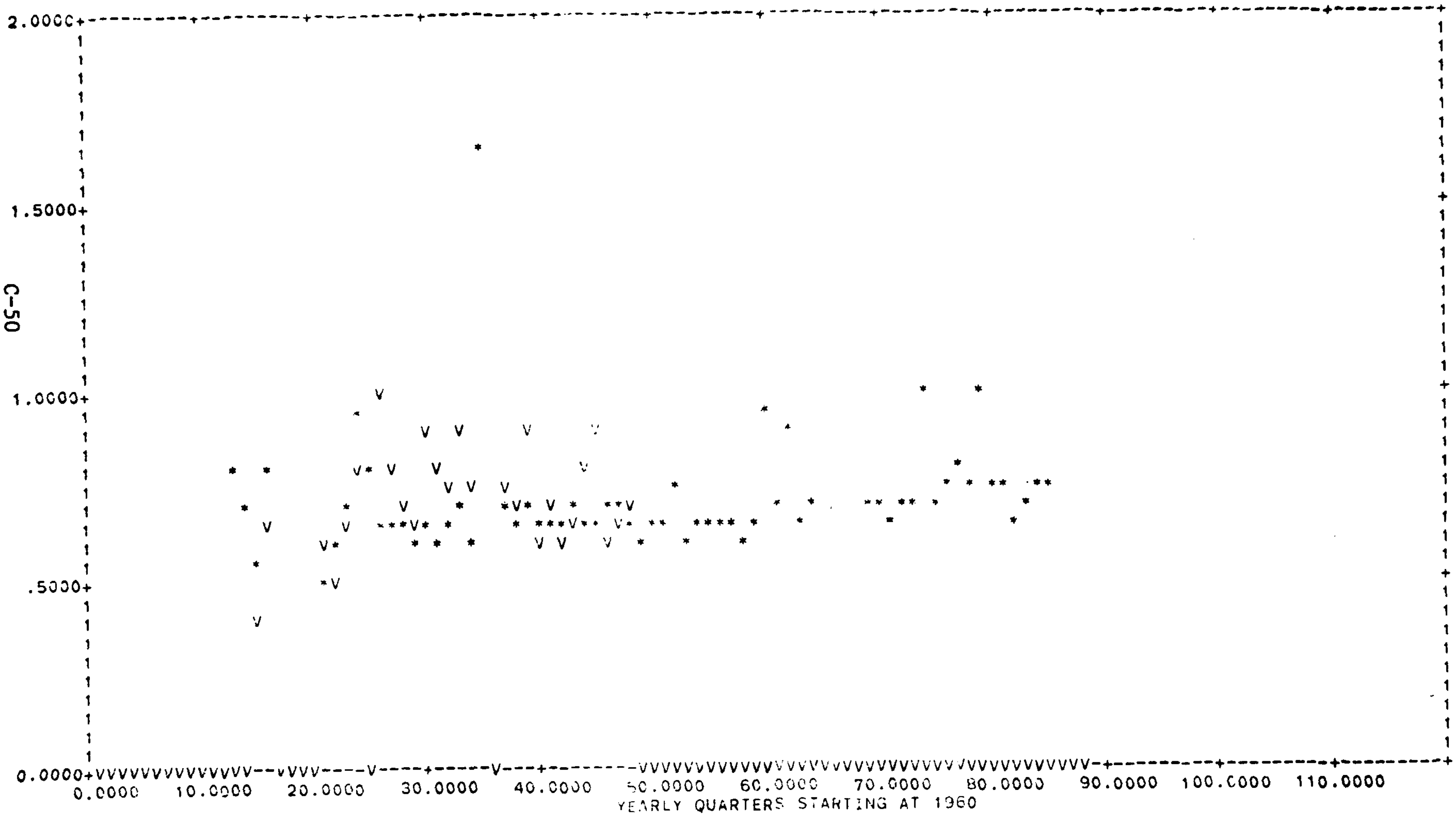


WORLDWIDE AVERAGE= .39 STANDARD DEVIATION= .7366 NUMBER OF OBSERVATIONS= 47
VIETNAM AVERAGE= .24 STANDARD DEVIATION= .0703 NUMBER OF OBSERVATIONS= 13

GRAPH-OUTLIER - AT 35. YVALUE= 5.195

SYSTEM=OV-1
YVARIABLE=

STANDARD DEVIATION OF LENGTH OF SORTIE BY AIRCRAFT

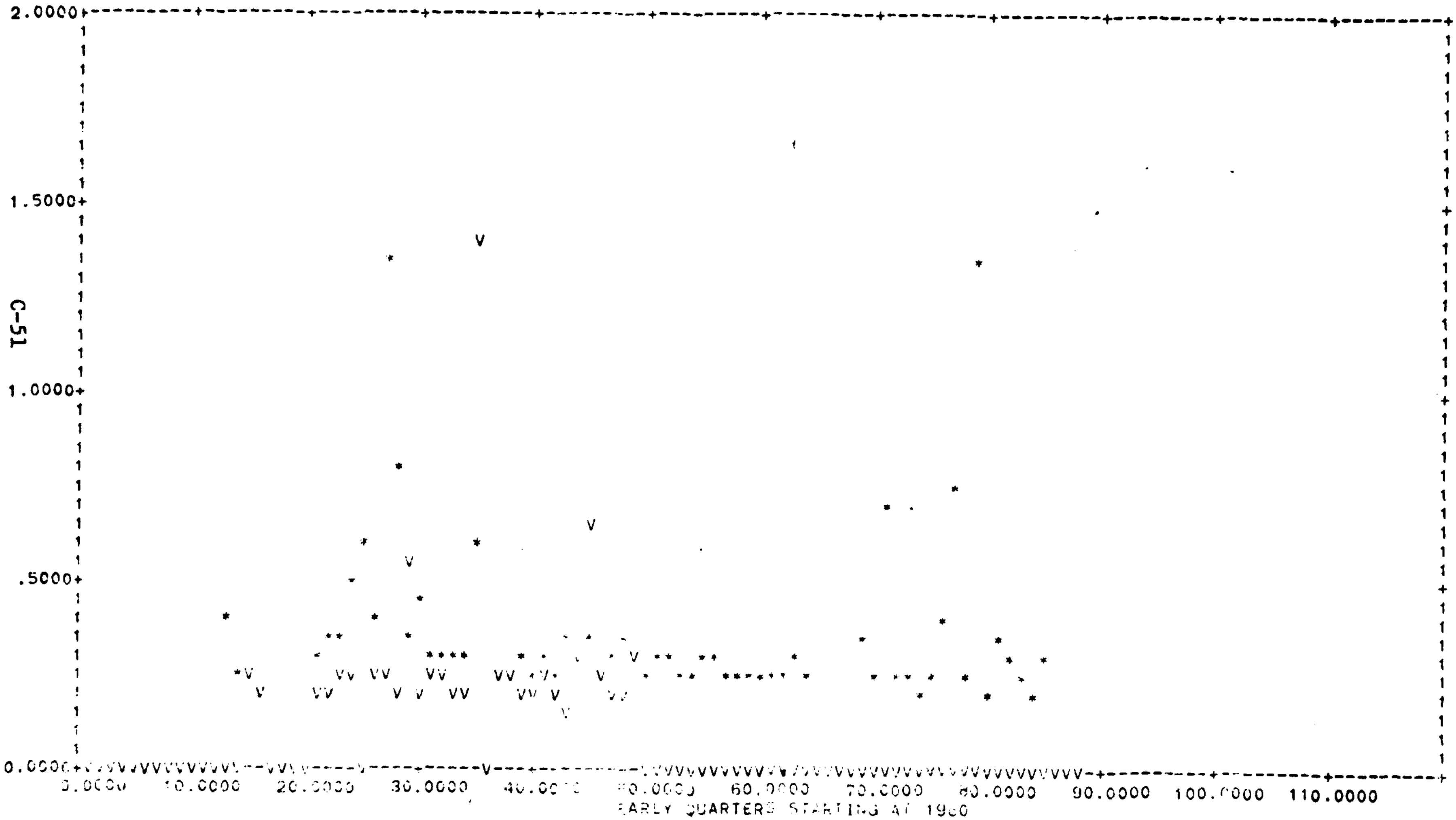


WORLDWIDE AVERAGE=	.71	STANDARD DEVIATION=	.1550	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.79	STANDARD DEVIATION=	.3517	NUMBER OF OBSERVATIONS=	28

GRAPH-OUTLIER V AT 35. YVALUE= 2.616

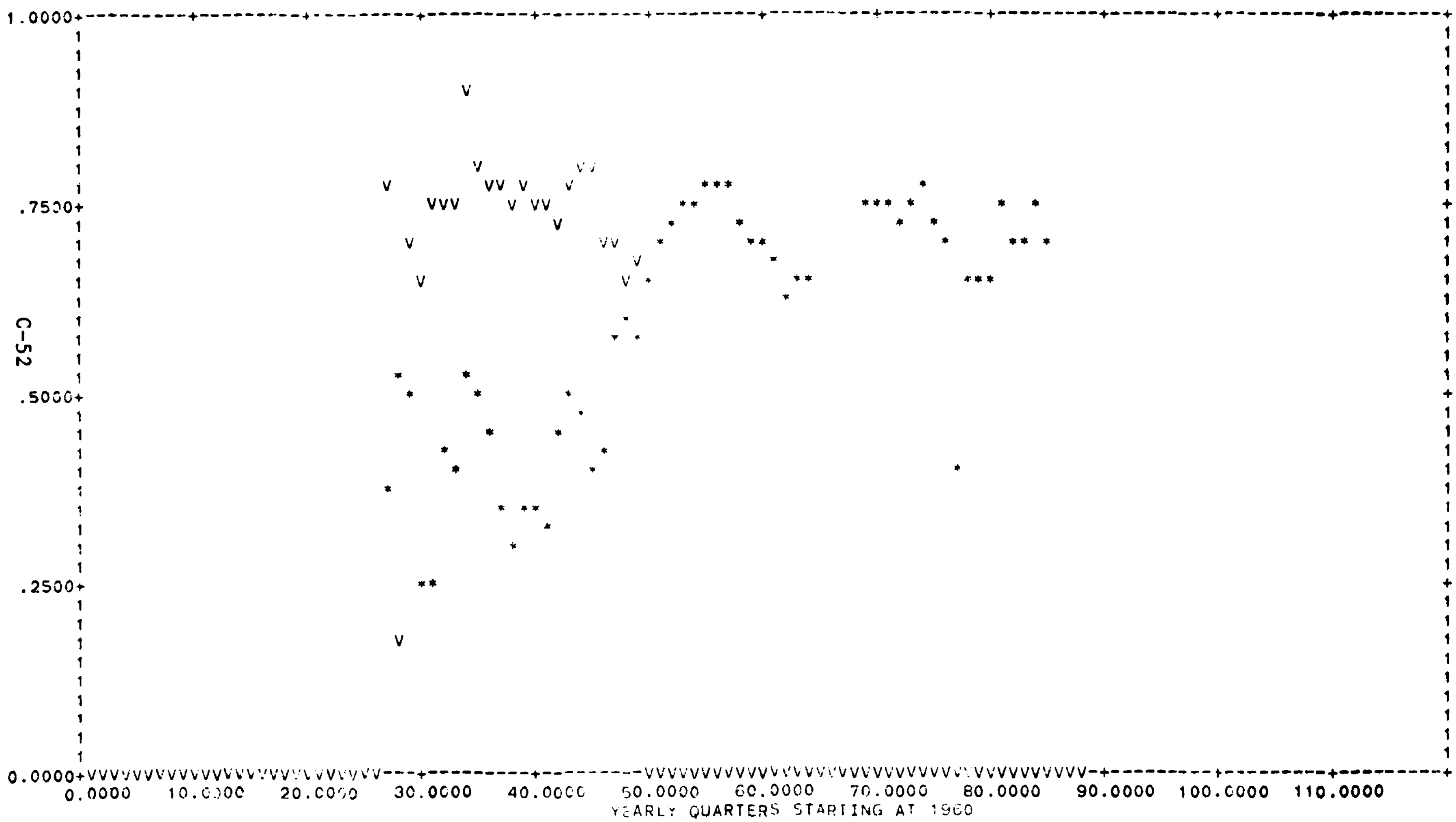
SYSTEM=UH-1
YVARIABLE=

STANDARD DEVIATION OF LENGTH OF SORTIE BY AIRCRAFT



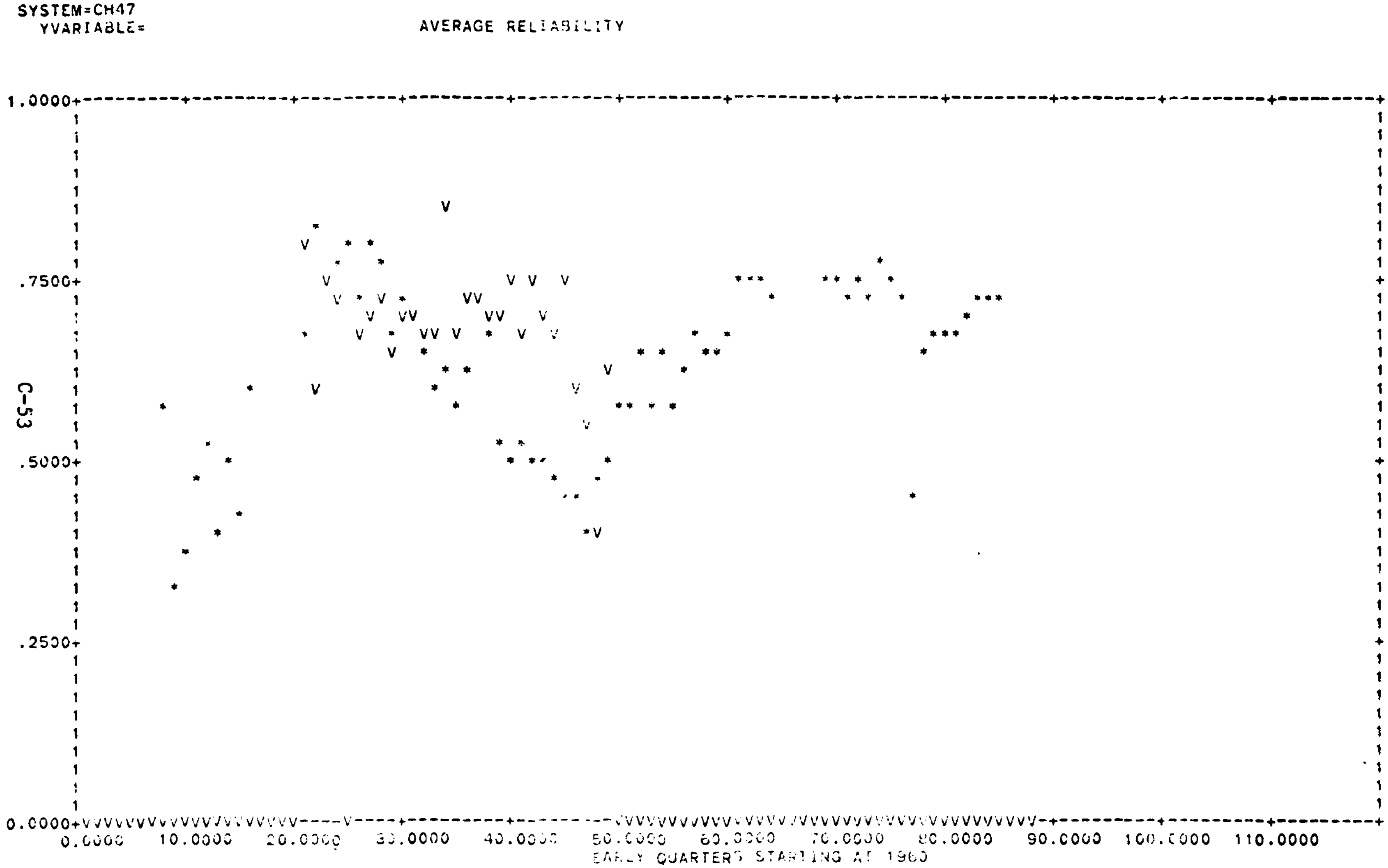
WORLDWIDE AVERAGE=	.36	STANDARD DEVIATION=	.2171	NUMBER OF OBSERVATIONS=	64
VIETNAM AVERAGE=	.29	STANDARD DEVIATION=	.2777	NUMBER OF OBSERVATIONS=	29

SYSTEM=AH-1
YVARIABLE=   AVERAGE RELIABILITY



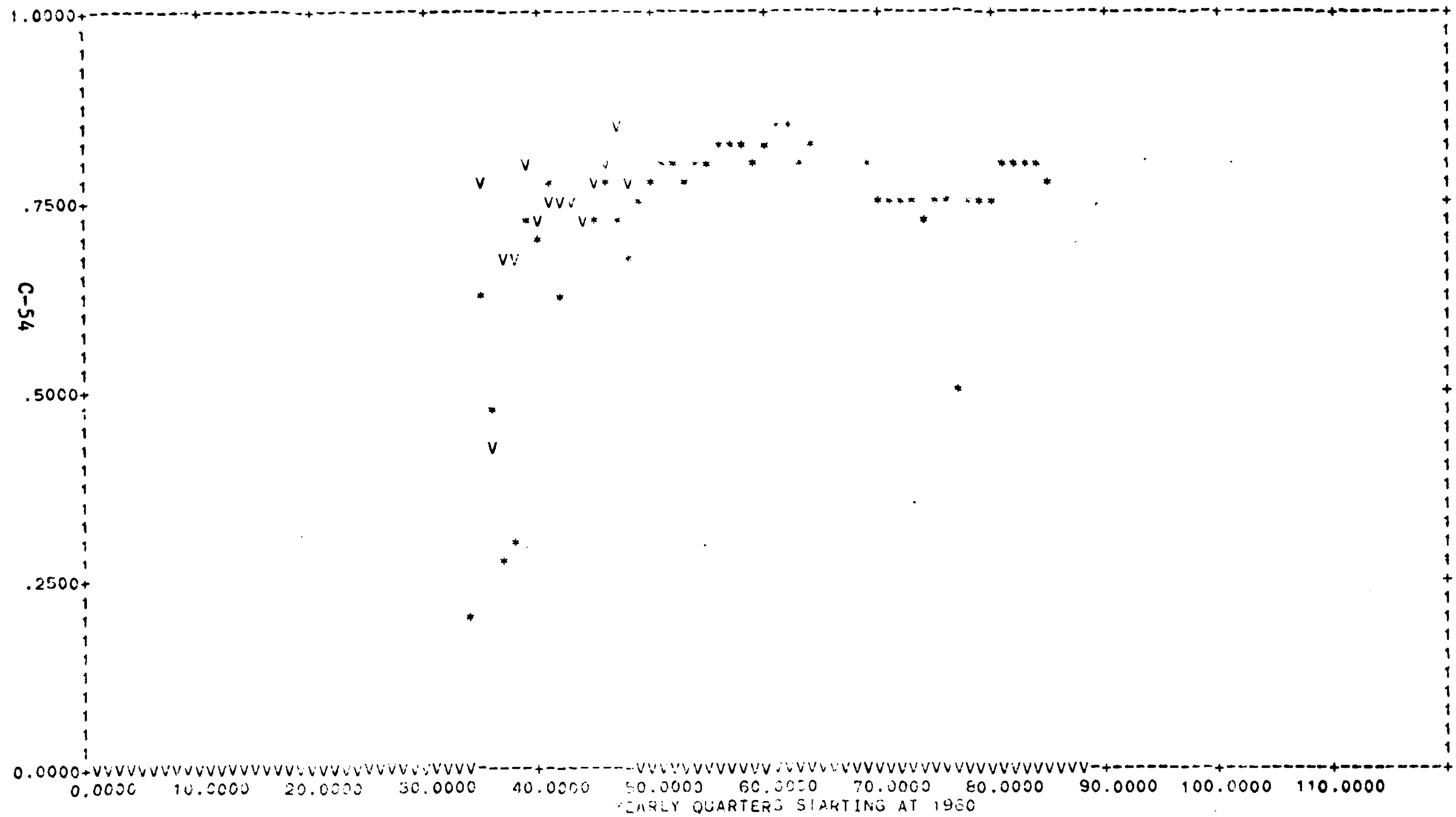
WORLDWIDE AVERAGE=	.59	STANDARD DEVIATION=	.1598	NUMBER OF OBSERVATIONS=	55
VIETNAM AVERAGE=	.72	STANDARD DEVIATION=	.1300	NUMBER OF OBSERVATIONS=	23

SYSTEM=CH47
YVARIABLE=



WORLDWIDE AVERAGE=	.63	STANDARD DEVIATION=	.1189	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	.69	STANDARD DEVIATION=	.0823	NUMBER OF OBSERVATIONS=	28

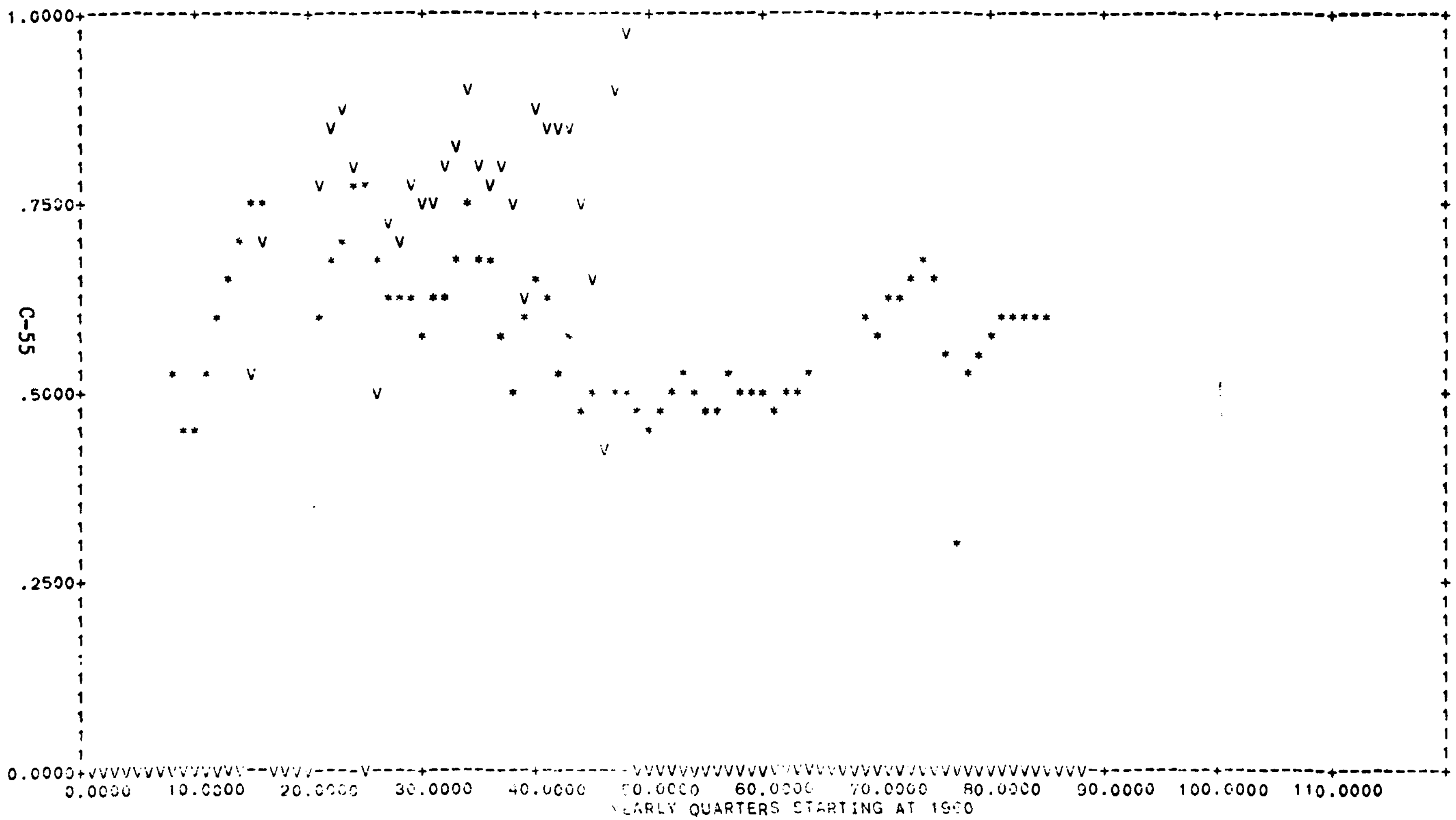
SYSTEM=
YVARIABLE=   AVERAGE RELIABILITY



WORLDWIDE AVERAGE=	.72	STANDARD DEVIATION=	.1419	NUMBER OF OBSERVATIONS=	48
VIETNAM AVERAGE=	.7[illegible]	STANDARD DEVIATION=	.1004	NUMBER OF OBSERVATIONS=	14

SYSTEM=OV-1
YVARIABLE=

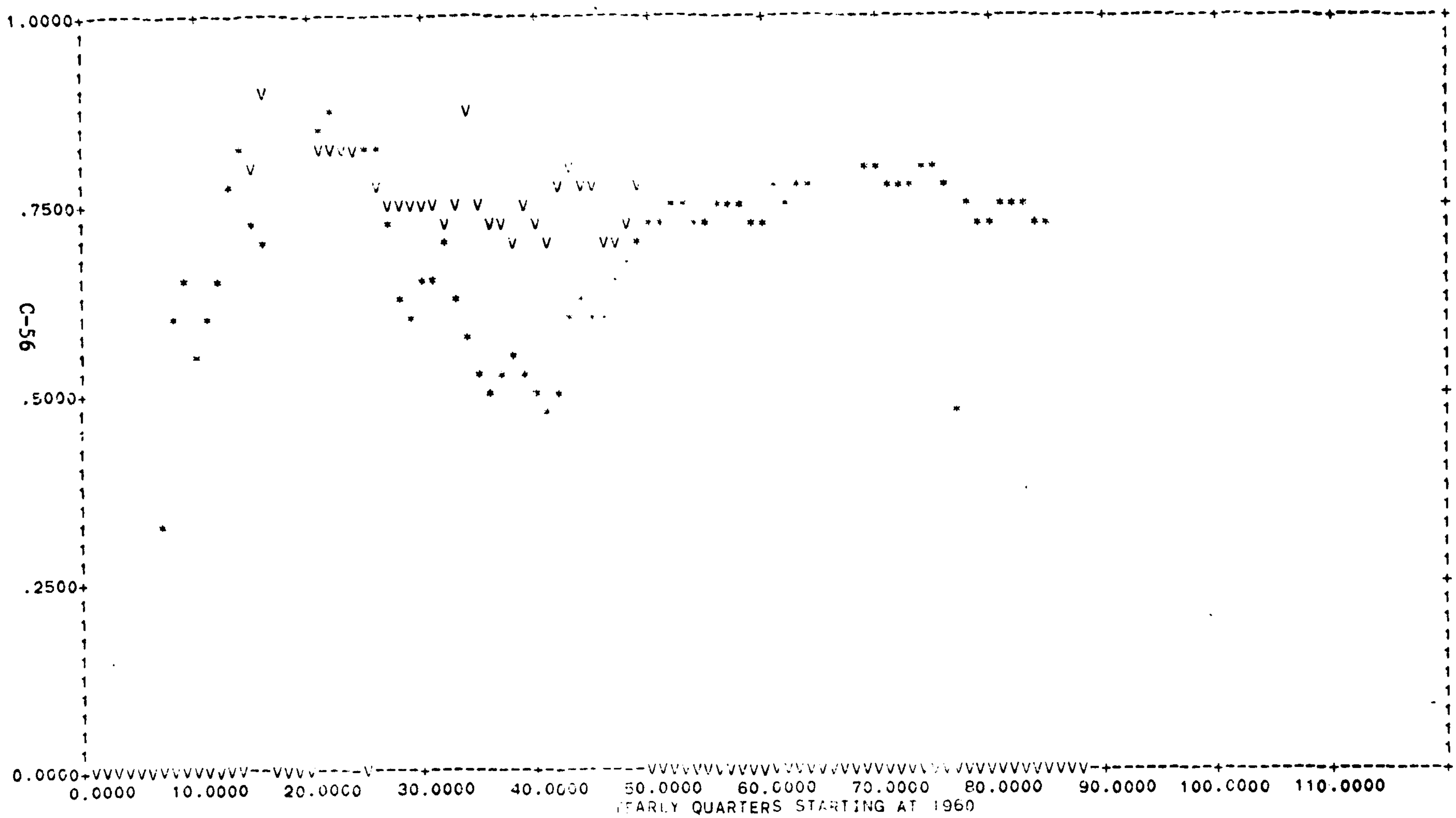
AVERAGE RELIABILITY



C-55

WORLDWIDE AVERAGE=	.5[illegible]	STANDARD DEVIATION=	.0[illegible]26	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	.76	STANDARD DEVIATION=	.1230	NUMBER OF OBSERVATIONS=	29

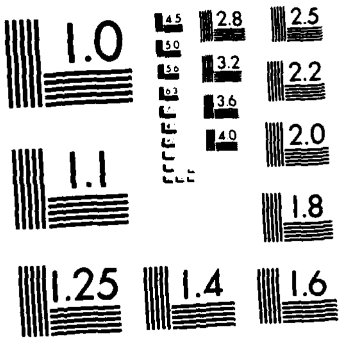
SYSTEM=UH-1
YVARIABLE= AVERAGE RELIABILITY



WORLDWIDE AVERAGE=	.69	STANDARD DEVIATION=	.1092	NUMBER OF OBSERVATIONS=	71
VIETNAM AVERAGE=	.77	STANDARD DEVIATION=	.0511	NUMBER OF OBSERVATIONS=	30

AD-A134 745 SORTIE DURATION AND HELICOPTER COMPONENT FAILURES (AN EMPIRICAL STUDY)(U) ARMY INVENTORY RESEARCH OFFICE PHILADELPHIA PA E GOTWALS MAY 83 USAIRO-TR-83/3 2/3

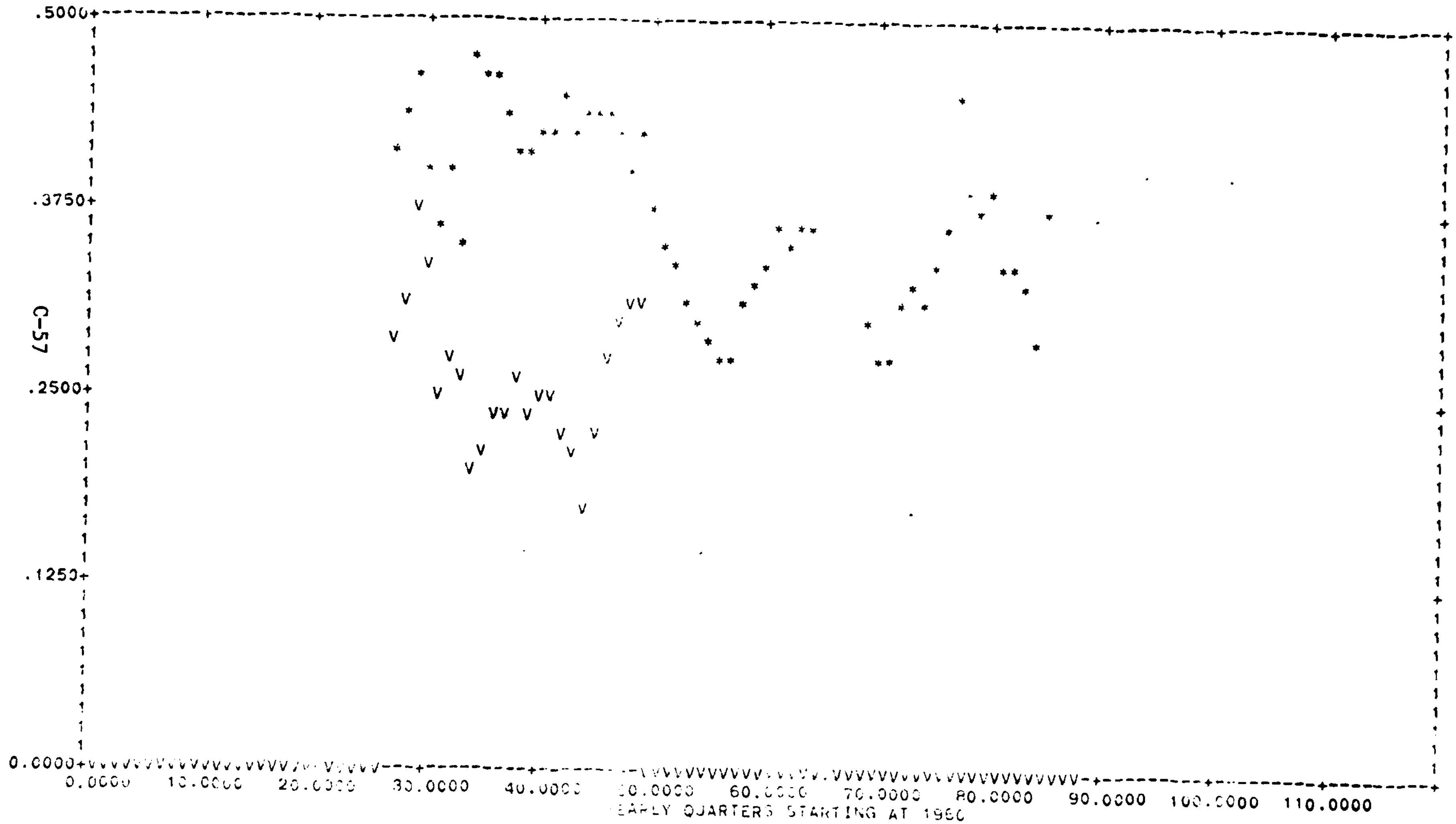
UNCLASSIFIED F/G 1/3 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SYSTEM AH-1
YVARIABLE=

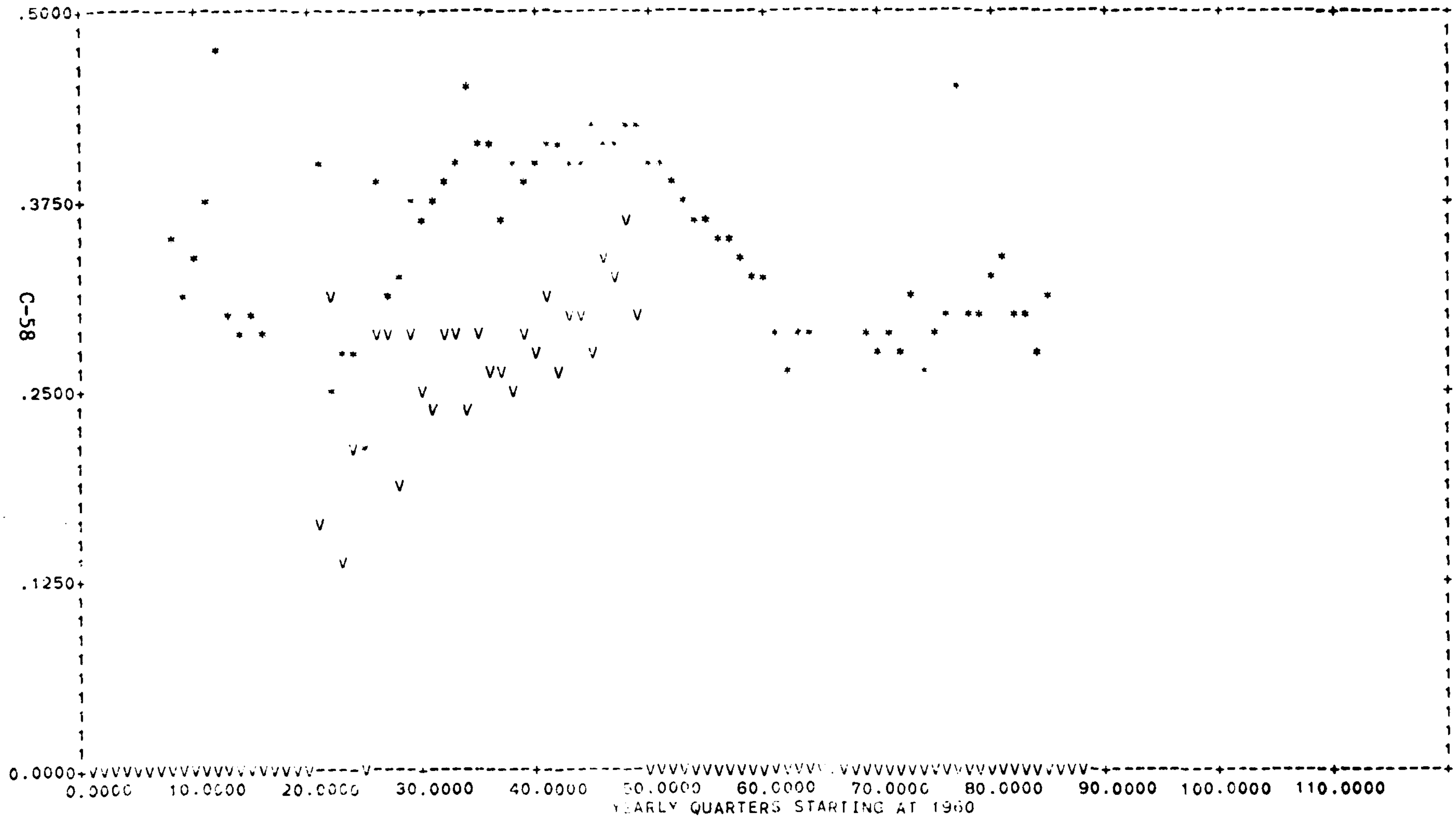
STANDARD DEVIATION OF RELIABILITY



WORLDWIDE AVERAGE= [illegible] STANDARD DEVIATION= .0574 NUMBER OF OBSERVATIONS= 55
VIETNAM AVERAGE= [illegible] STANDARD DEVIATION= [illegible] NUMBER OF OBSERVATIONS= 23

SYSTEM-CH47
YVARIABLE-

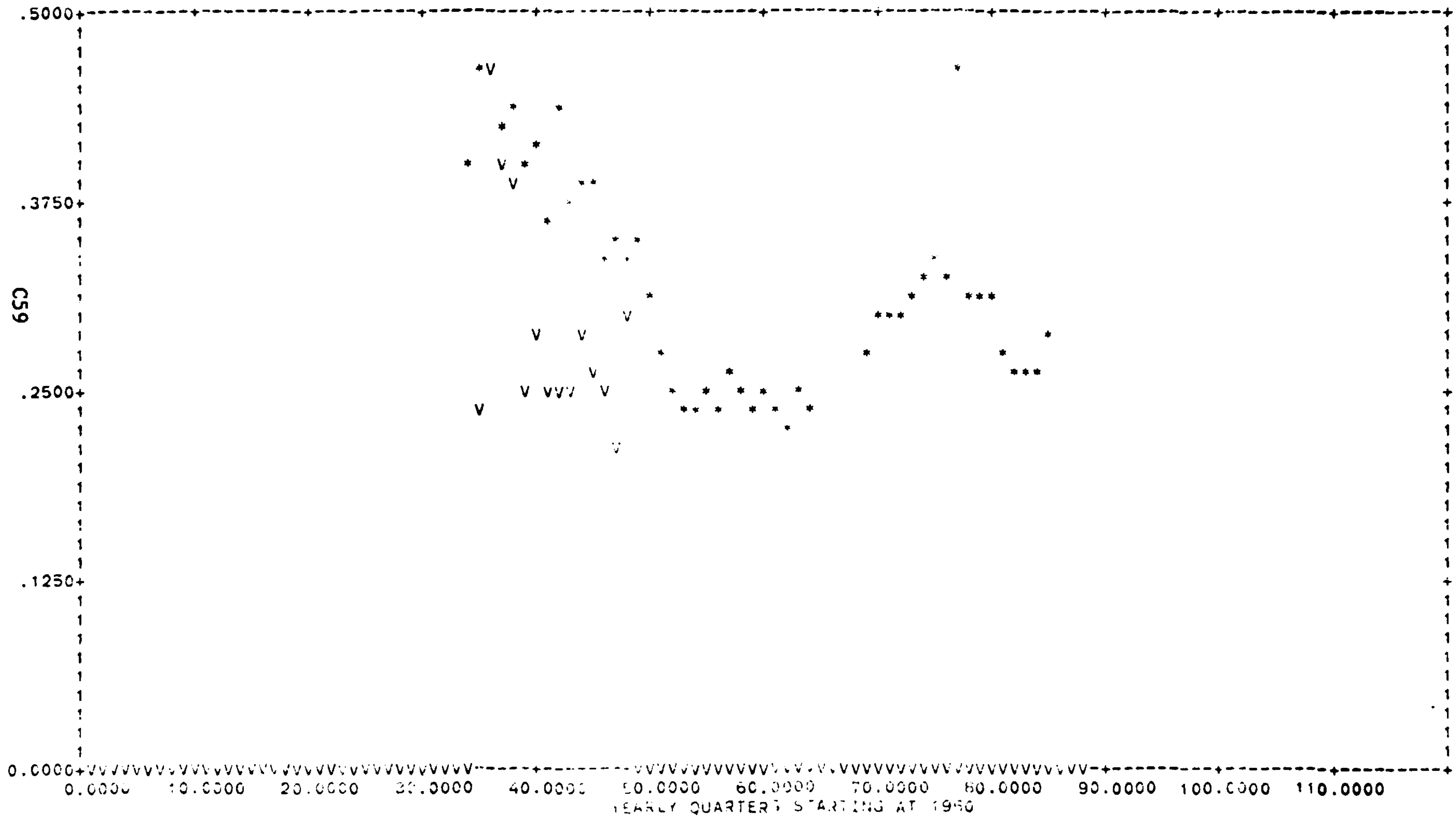
STANDARD DEVIATION OF RELIABILITY



WORLDWIDE AVERAGE= .35 STANDARD DEVIATION= .0580 NUMBER OF OBSERVATIONS= 70
VIETNAM AVERAGE= .27 STANDARD DEVIATION= .0603 NUMBER OF OBSERVATIONS= 28

SYSTEM-0H56
YVARIABLE=

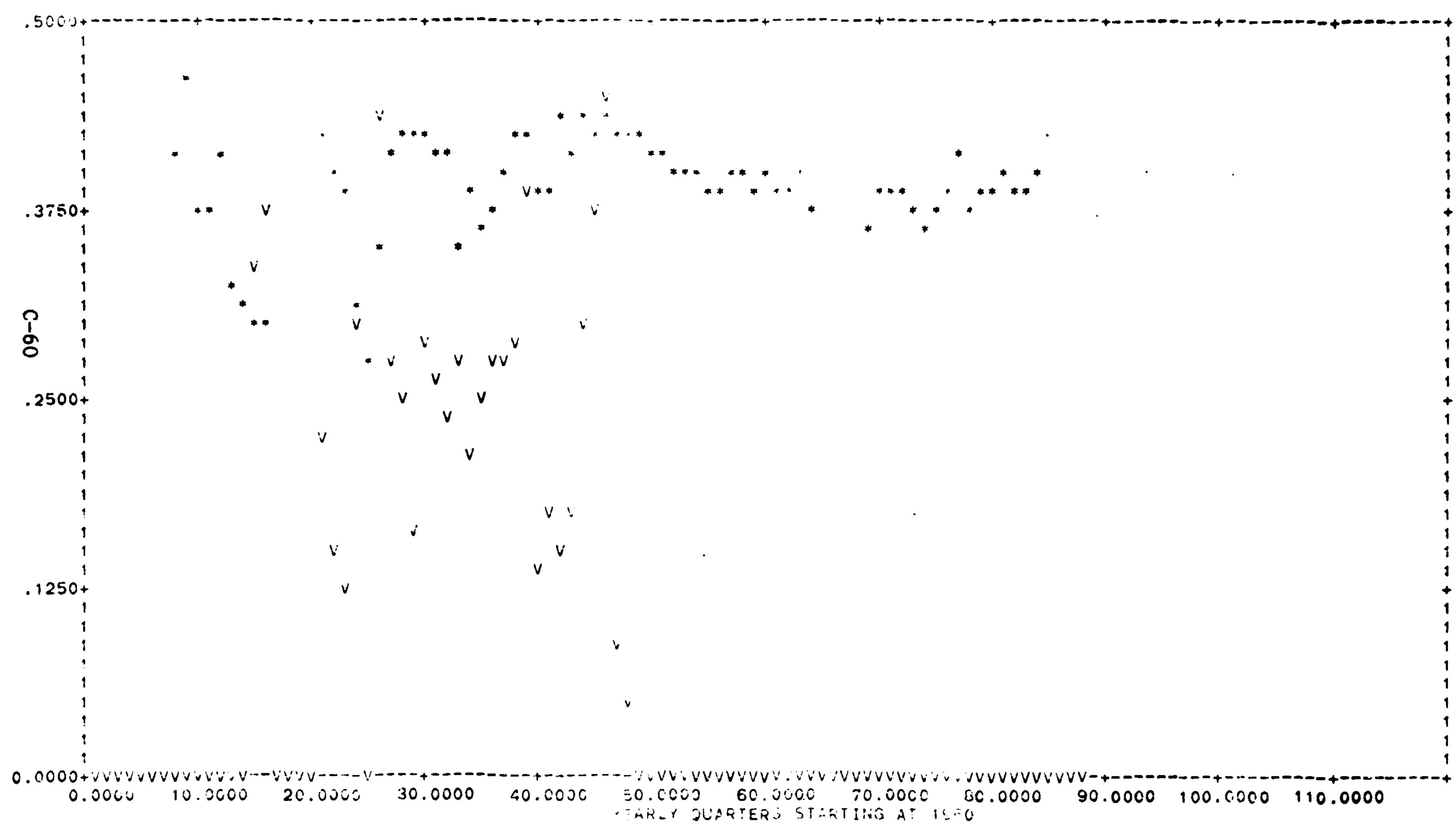
STANDARD DEVIATION OF RELIABILITY



WORLDWIDE AVERAGE= .32 STANDARD DEVIATION= .0697 NUMBER OF OBSERVATIONS= 48
VIETNAM AVERAGE= .29 STANDARD DEVIATION= .0722 NUMBER OF OBSERVATIONS= 14

SYSTEM=OV-1
YVARIABLE=

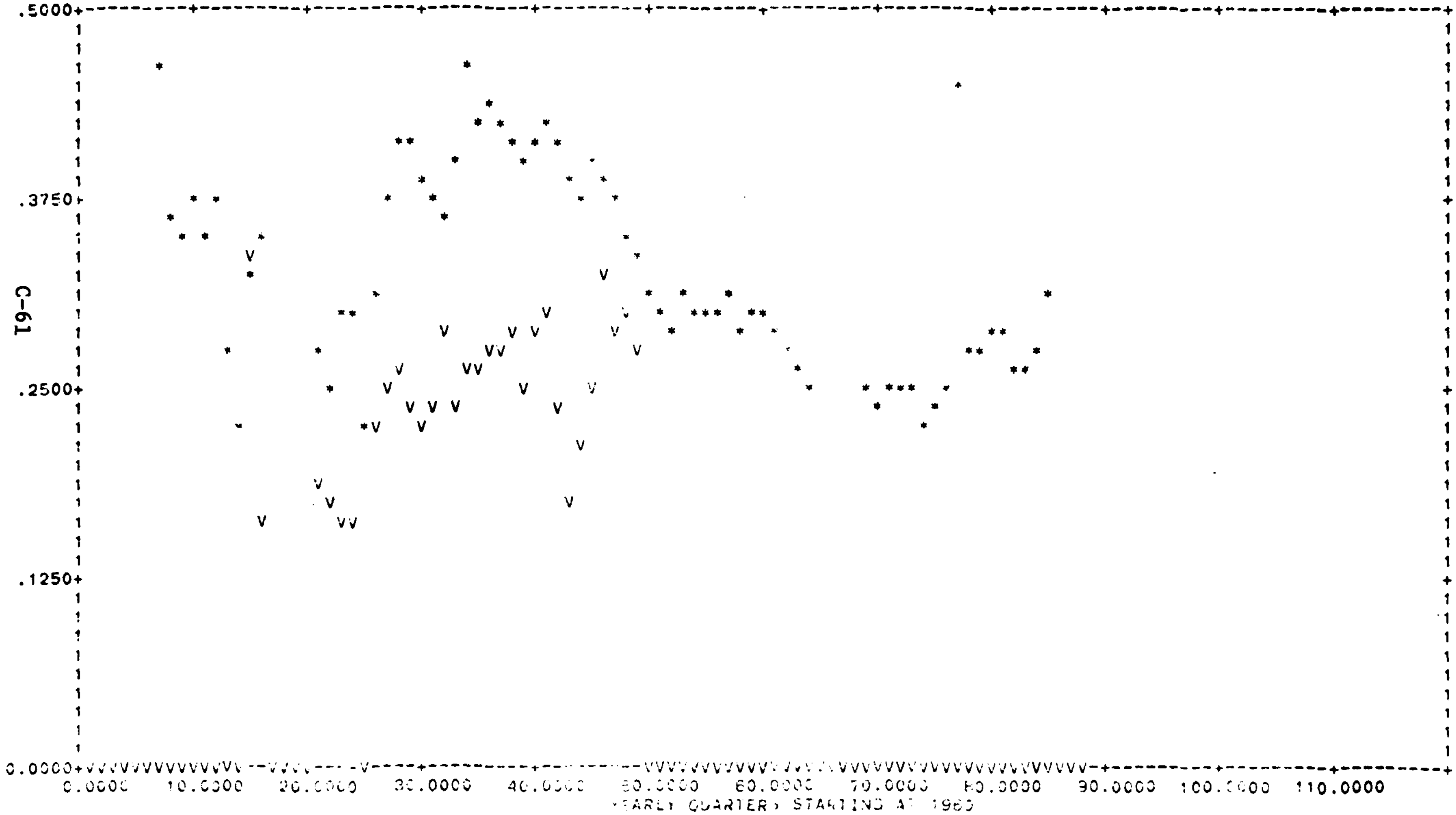
STANDARD DEVIATION OF RELIABILITY



WORLDWIDE AVERAGE= .39 STANDARD DEVIATION= .0346 NUMBER OF OBSERVATIONS= 70
VIETNAM AVERAGE= .25 STANDARD DEVIATION= .0998 NUMBER OF OBSERVATIONS= 29

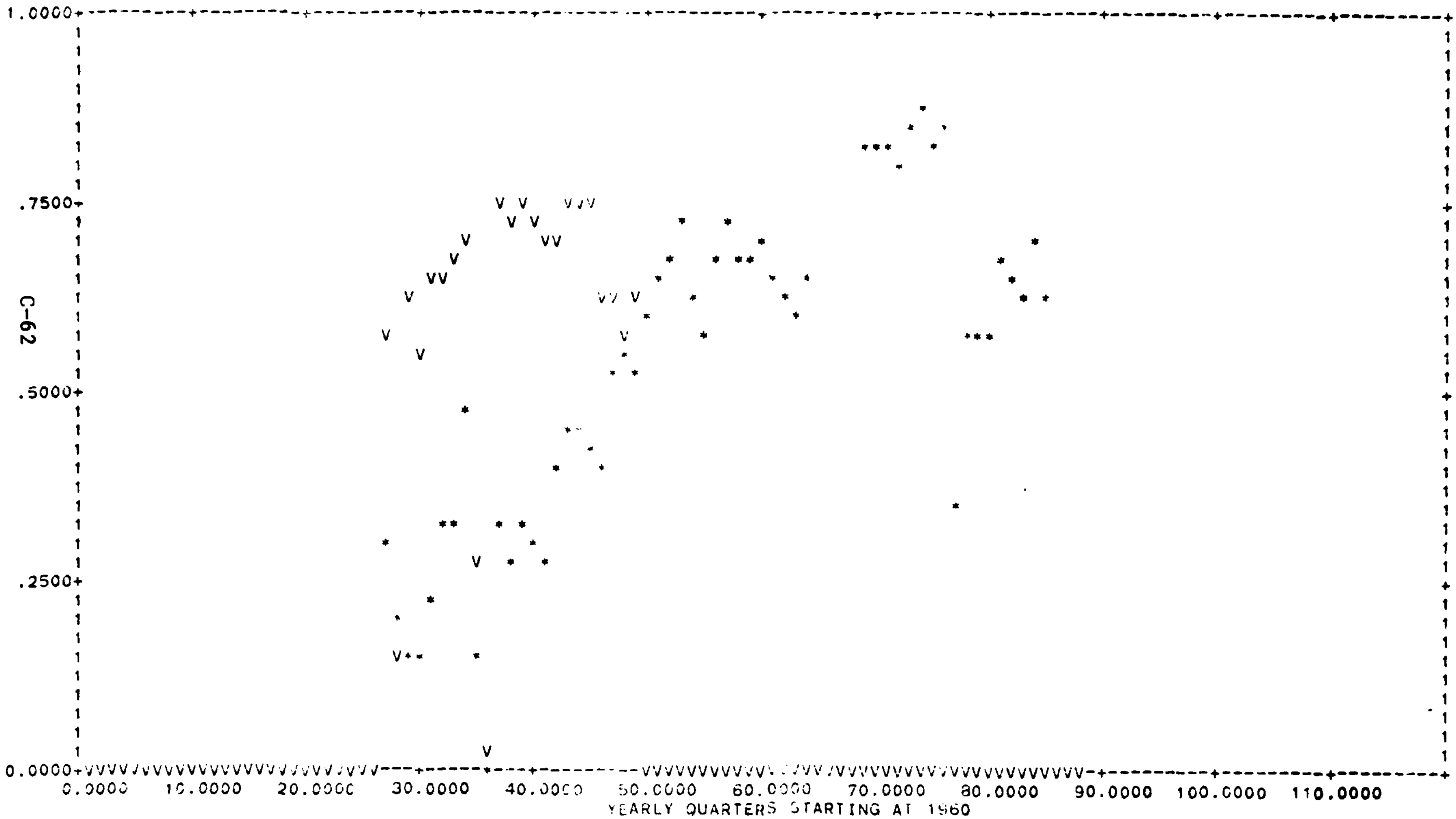
SYSTEM=UH-1
YVARIABLE=

STANDARD DEVIATION OF RELIABILITY



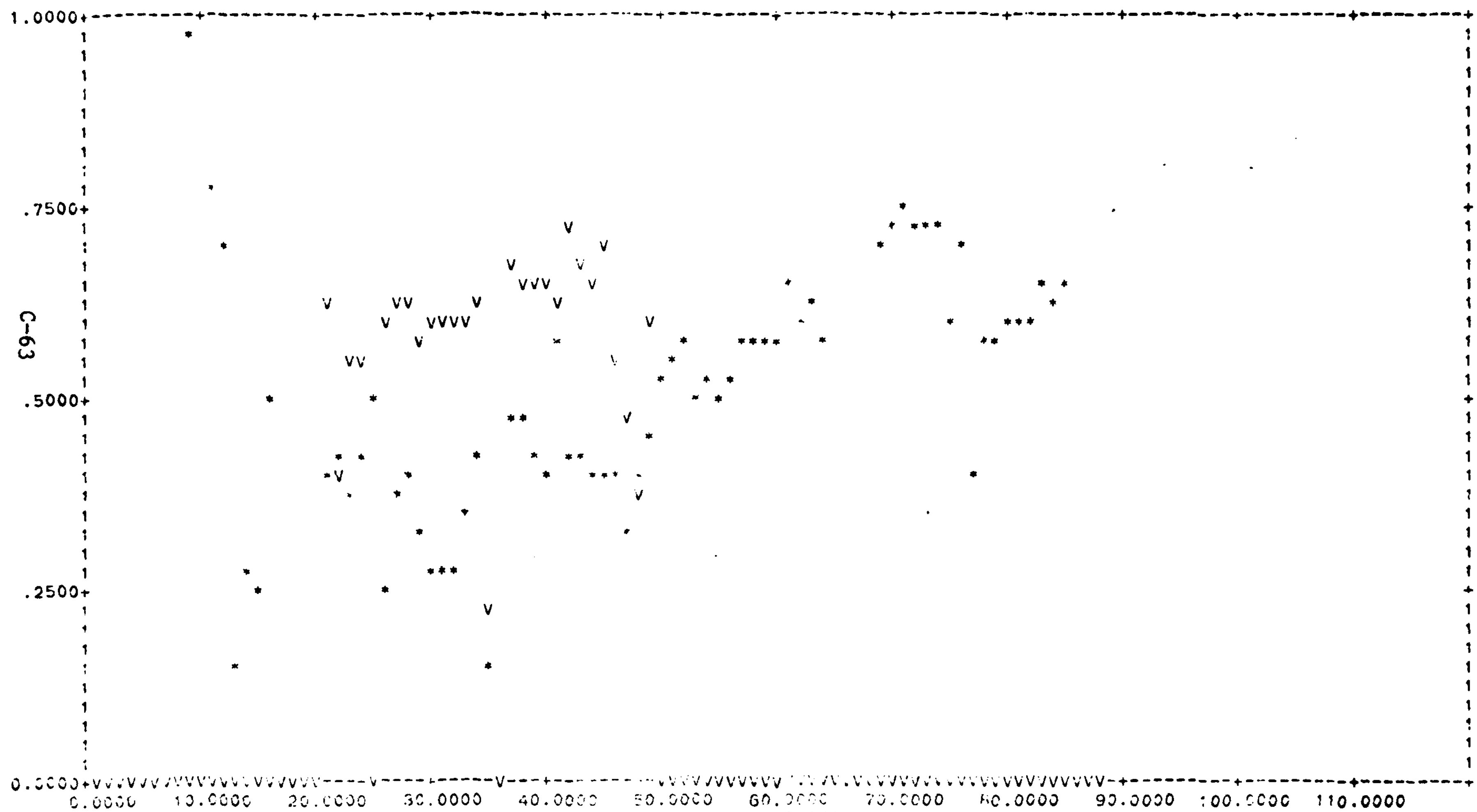
WORLDWIDE AVERAGE=	.33	STANDARD DEVIATION=	.0487	NUMBER OF OBSERVATIONS=	71
VIETNAM AVERAGE=	.25	STANDARD DEVIATION=	.0430	NUMBER OF OBSERVATIONS=	30

SYSTEM=AH-1
YVARIABLE= AVERAGE AVAILABILITY



WORLDWIDE AVERAGE=	.55	STANDARD DEVIATION=	.2042	NUMBER OF OBSERVATIONS=	54
VIETNAM AVERAGE=	.60	STANDARD DEVIATION=	.1934	NUMBER OF OBSERVATIONS=	23

SYSTEM=CH47
YVARIABLE= AVERAGE AVAILABILITY

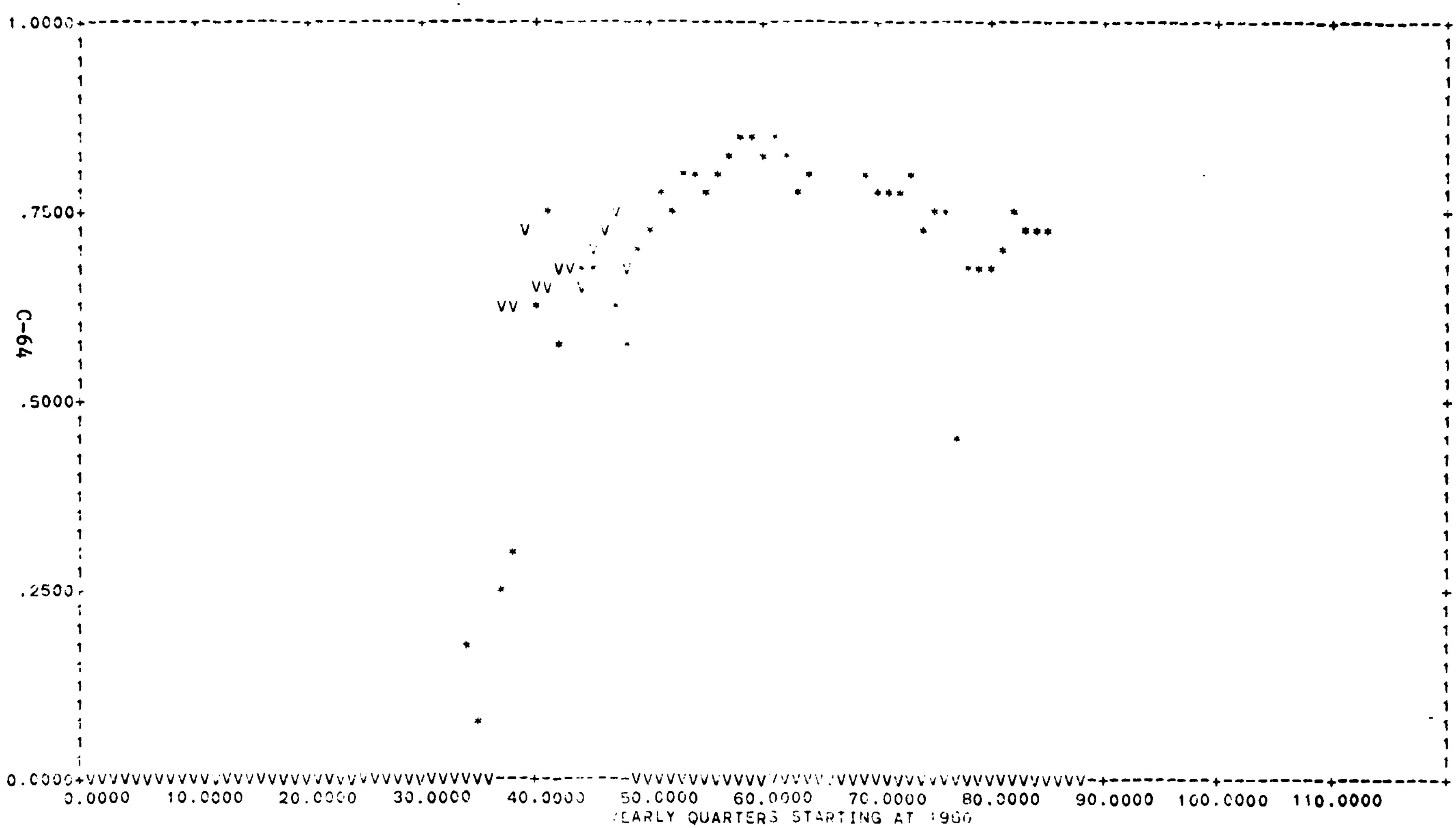


WORLDWIDE AVERAGE=	.54	STANDARD DEVIATION=	.2444	NUMBER OF OBSERVATIONS=	69
VIETNAM AVERAGE=	.56	STANDARD DEVIATION=	[illegible]	NUMBER OF OBSERVATIONS=	28

GRAPH-OUTLIER AT [illegible] YVALUE= [illegible]
GRAPH-OUTLIER [illegible] 10. YVALUE= [illegible]

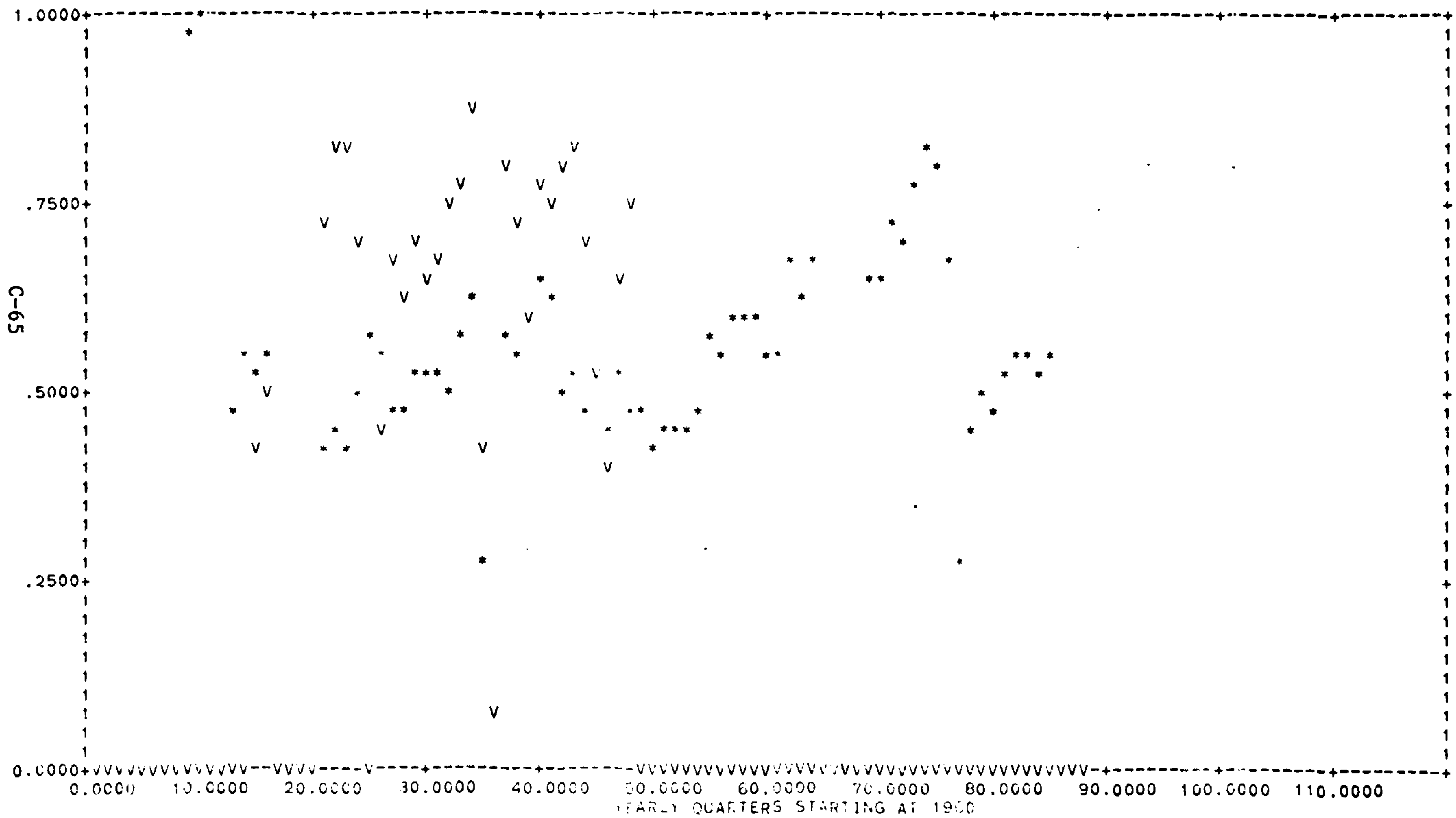
SYSTEM-OH58
YVARIABLE

AVERAGE AVAILABILITY



WORLDWIDE AVERAGE=	.69	STANDARD DEVIATION=	.1725	NUMBER OF OBSERVATIONS=	47
VIETNAM AVERAGE=	.68	STANDARD DEVIATION=	.0406	NUMBER OF OBSERVATIONS=	12

SYSTEM=OV-1
YVARIABLE=   AVERAGE AVAILABILITY

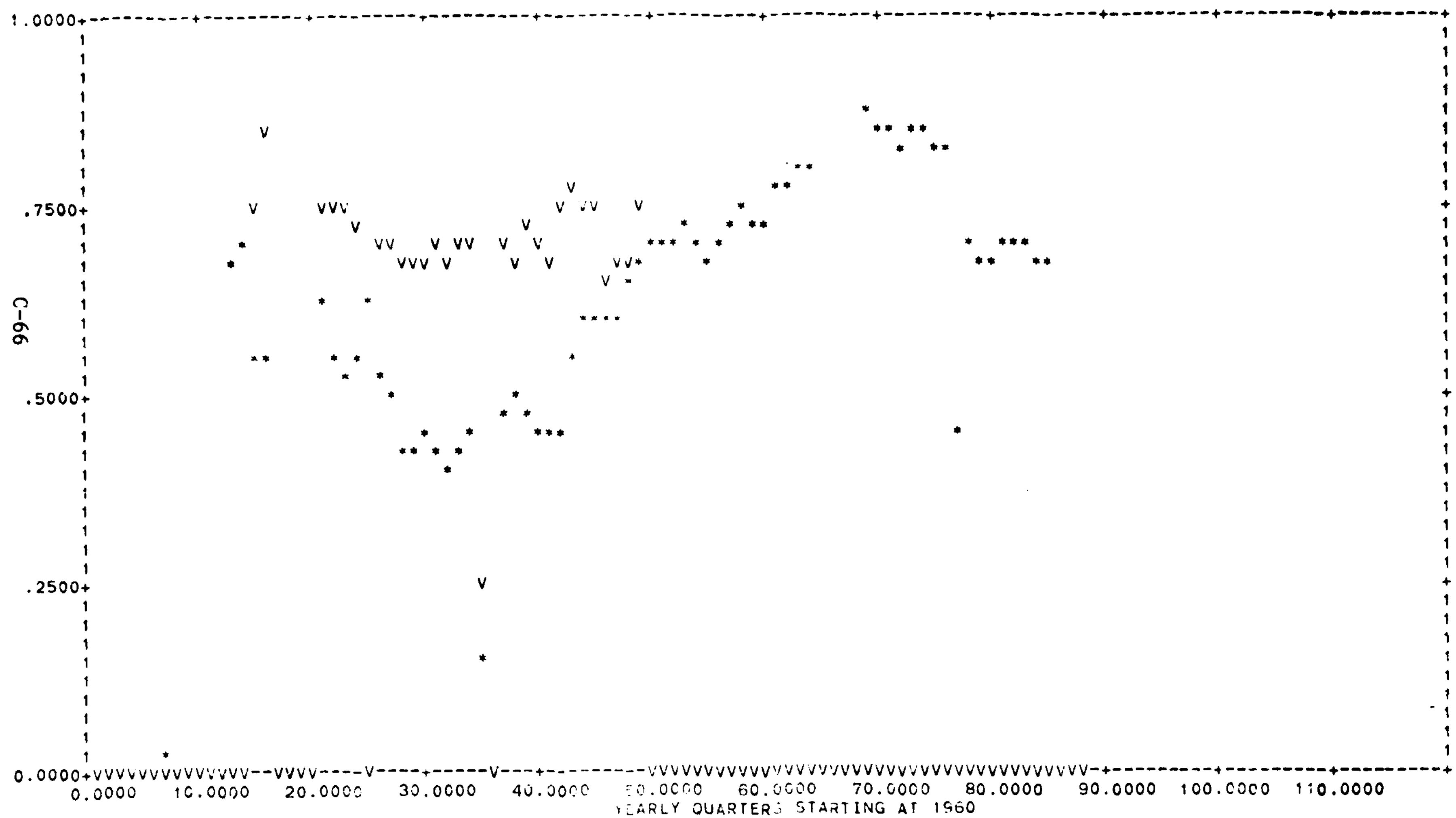


C-65

WORLDWIDE AVERAGE=	.58	STANDARD DEVIATION=	.1753	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	.66	STANDARD DEVIATION=	.1728	NUMBER OF OBSERVATIONS=	29

GRAPH-OUTLIER * AT [illegible]. YVALUE= 1.128
GRAPH-OUTLIER * AT 10. YVALUE= 1.0[illegible]
GRAPH-OUTLIER * AT 11. YVALUE= 1.073
GRAPH-OUTLIER * AT 12. YVALUE= 1.089

SYSTEM=UH-1
YVARIABLE= AVERAGE AVAILABILITY

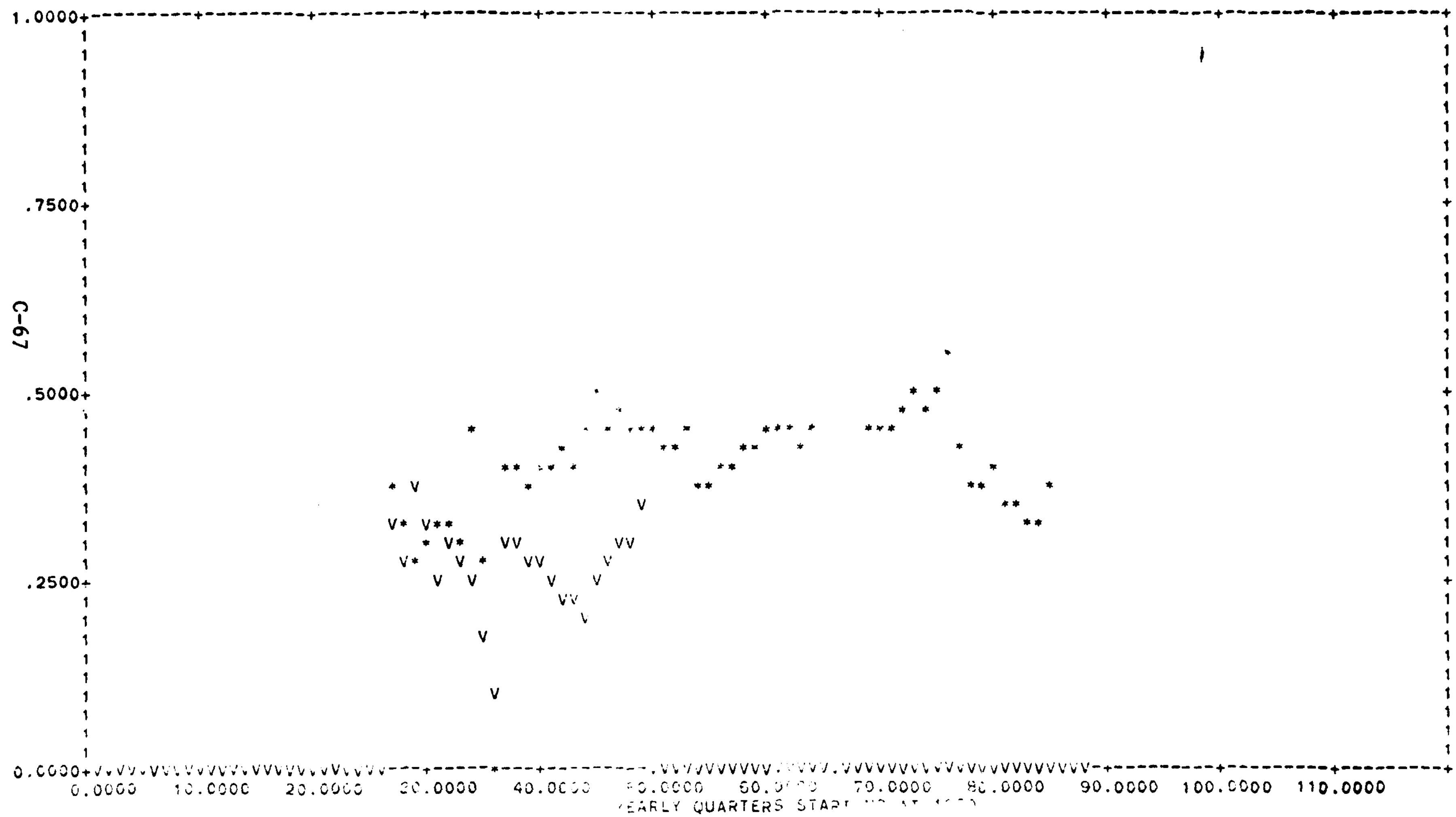


WORLDWIDE AVERAGE=	.66	STANDARD DEVIATION=	.2613	NUMBER OF OBSERVATIONS=	71
VIETNAM AVERAGE=	.68	STANDARD DEVIATION=	.1577	NUMBER OF OBSERVATIONS=	30

GRAPH-OUTLIER * AT 8. YVALUE= 1.228
GRAPH-OUTLIER * AT 9. YVALUE= 1.635
GRAPH-OUTLIER * AT 10. YVALUE= 1.113
GRAPH-OUTLIER * AT 11. YVALUE= 1.402

SYSTEM=AH-1
YVARIABLE=

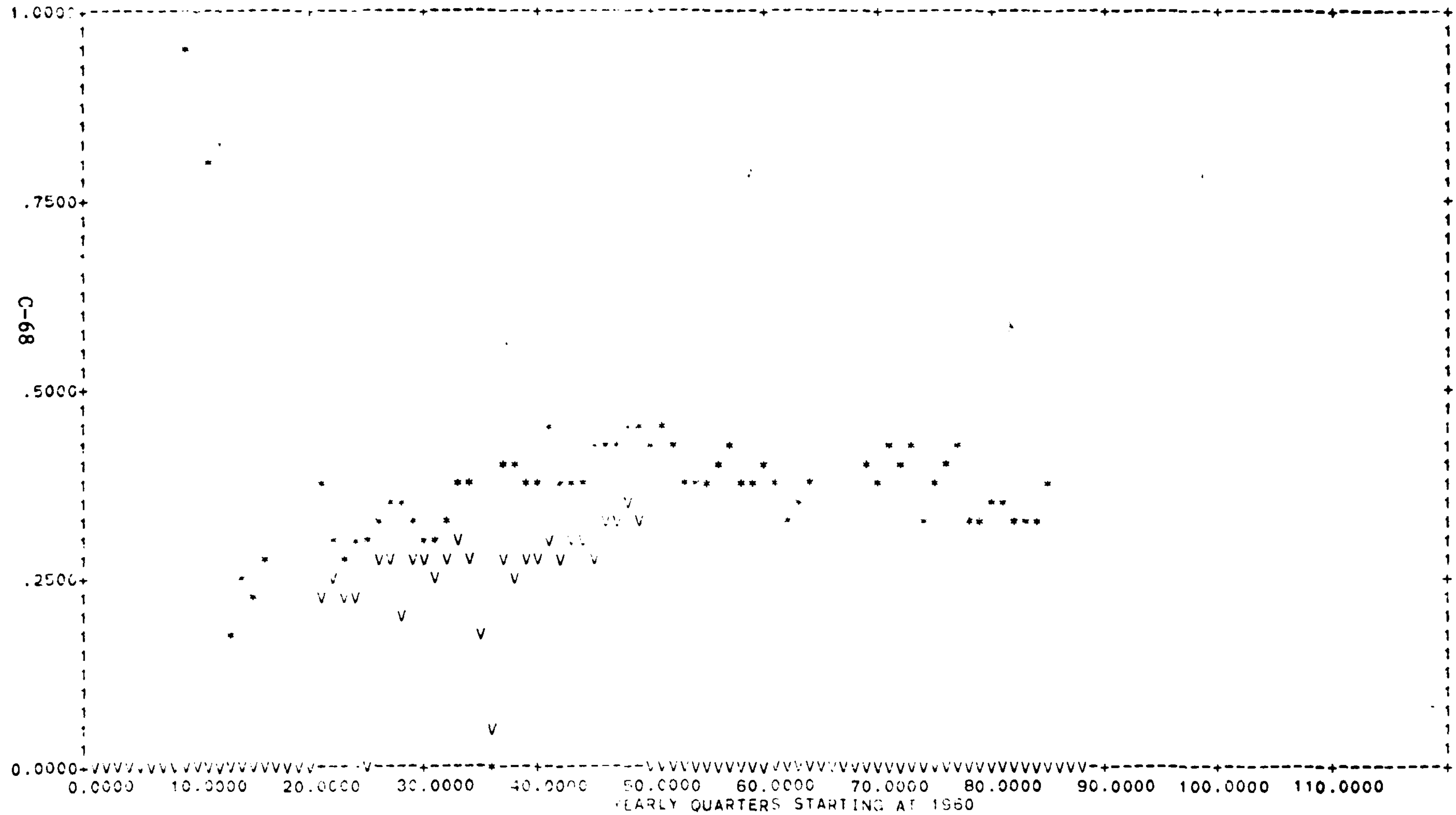
STANDARD DEVIATION OF AVAILABILITY



WORLDWIDE AVERAGE= .41 STANDARD DEVIATION= .0586 NUMBER OF OBSERVATIONS= 54
VIETNAM AVERAGE= .27 STANDARD DEVIATION= .0807 NUMBER OF OBSERVATIONS= 23

SYSTEM=
YVARIABLE=

STANDARD DEVIATION OF AVAILABILITY

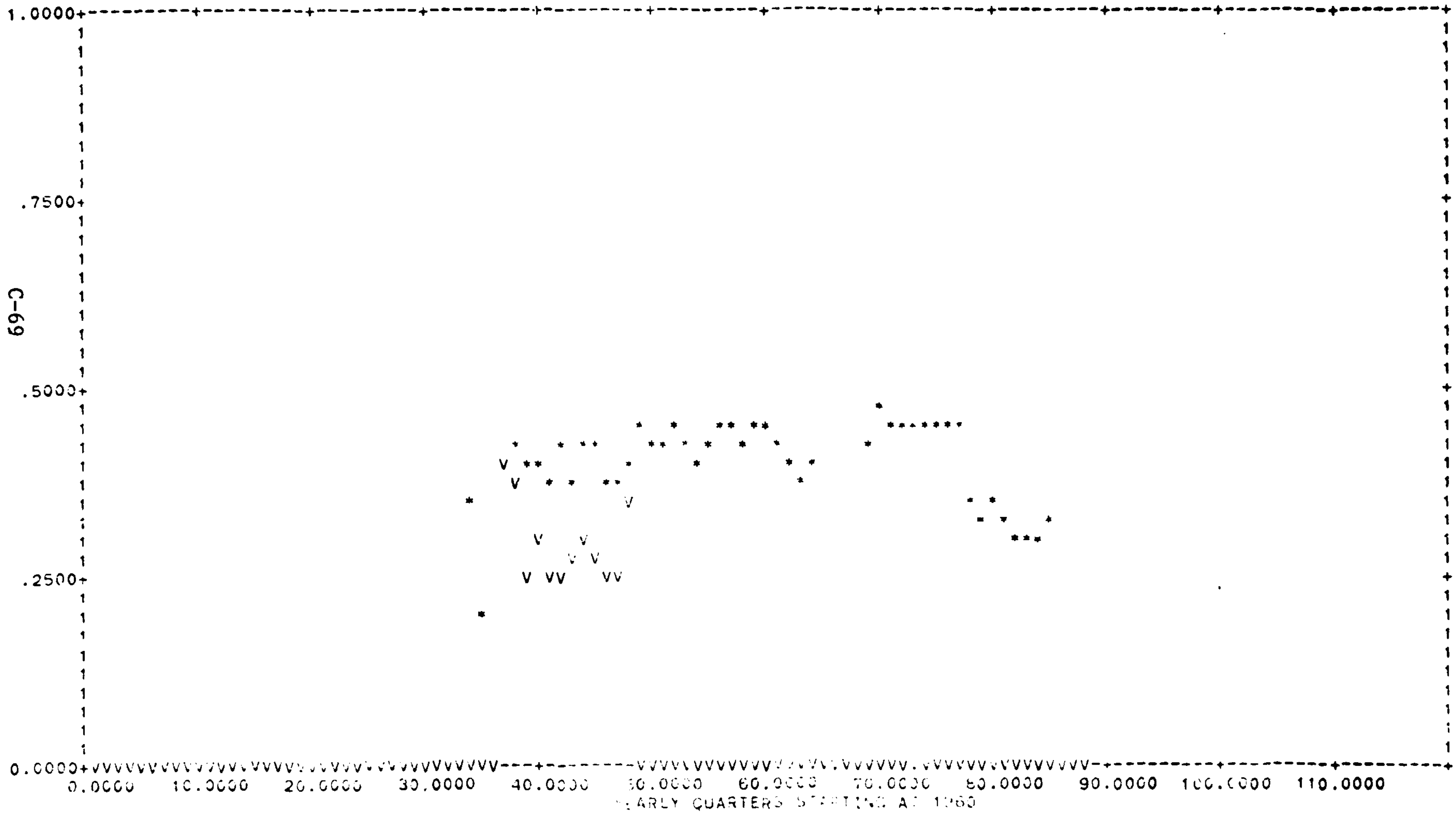


WORLDWIDE AVERAGE= .41 STANDARD DEVIATION= .1840 NUMBER OF OBSERVATIONS= 69
VIETNAM AVERAGE= .26 STANDARD DEVIATION= .0553 NUMBER OF OBSERVATIONS= 28

GRAPH-OUTLIER * AT 8. YVALUE= 1.291
GRAPH-OUTLIER * AT 10. YVALUE= 1.132

SYSTEM=OH58
YVARIABLE=

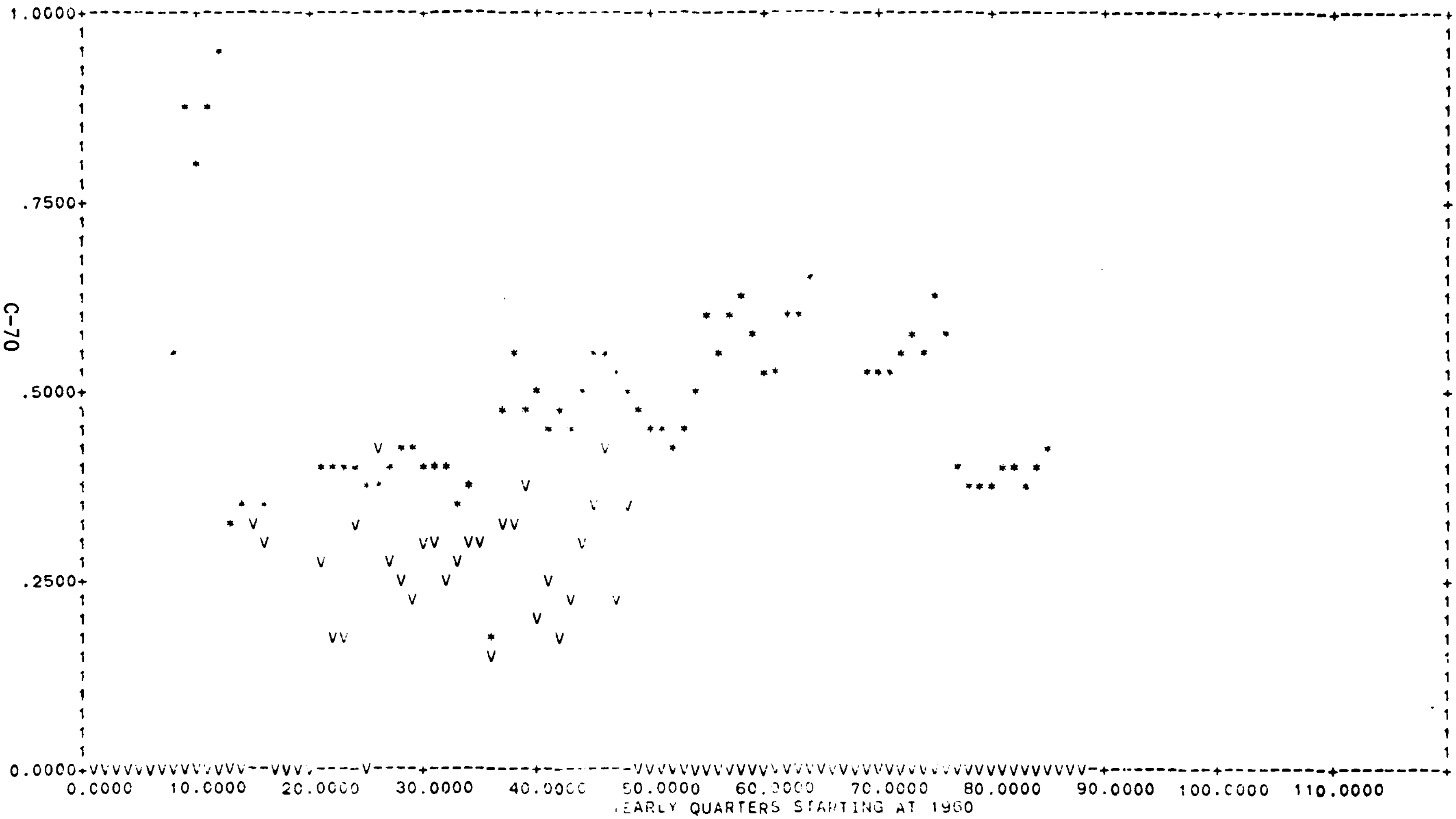
STANDARD DEVIATION OF AVAILABILITY



WORLDWIDE AVERAGE=	.40	STANDARD DEVIATION=	.0550	NUMBER OF OBSERVATIONS=	47
VIETNAM AVERAGE=	.29	STANDARD DEVIATION=	.0500	NUMBER OF OBSERVATIONS=	12

SYSTEM=OV-1
YVARIABLE=

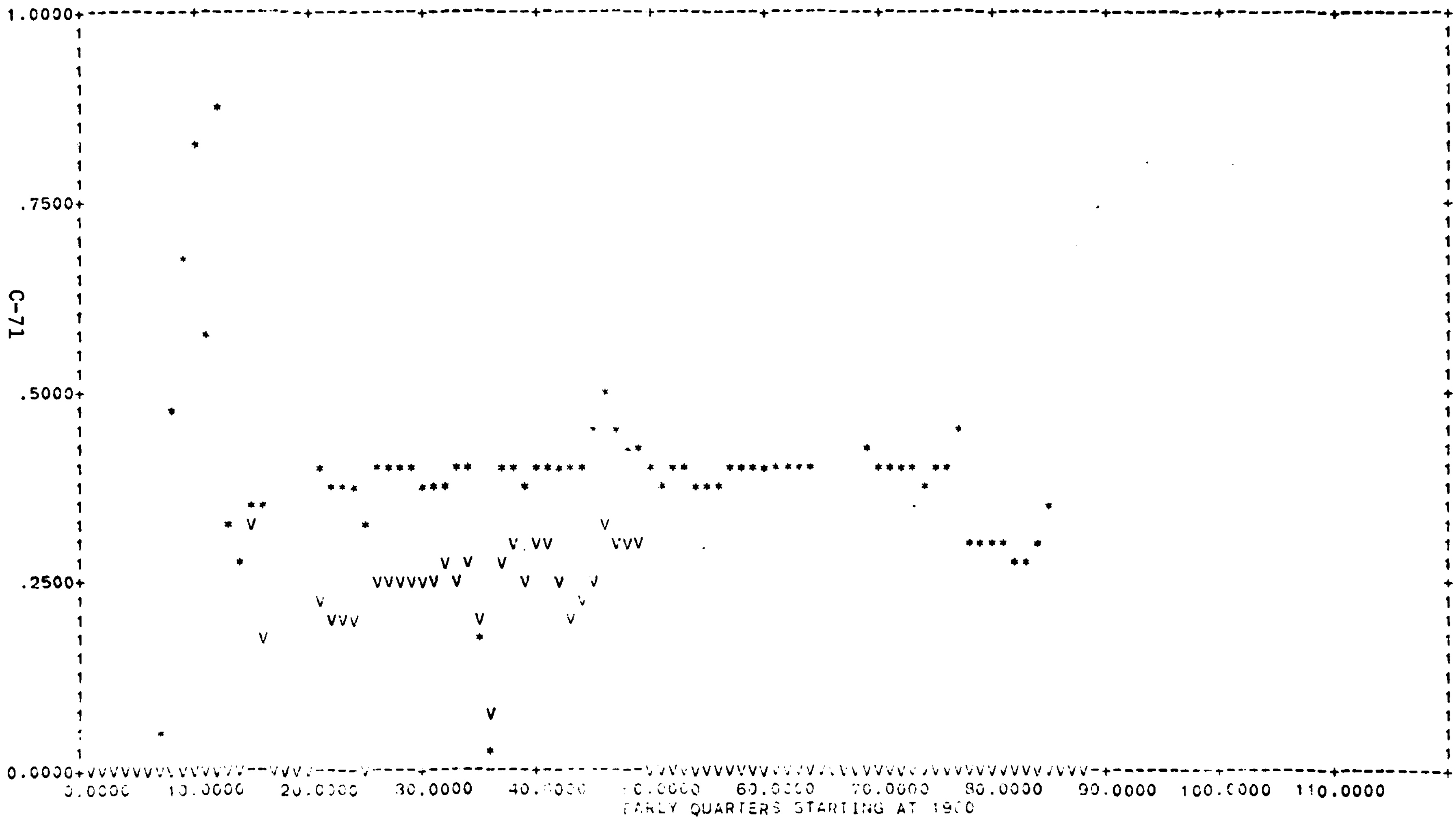
STANDARD DEVIATION OF AVAILABILITY



WORLDWIDE AVERAGE=	.49	STANDARD DEVIATION=	.1345	NUMBER OF OBSERVATIONS=	70
VIETNAM AVERAGE=	.28	STANDARD DEVIATION=	.0795	NUMBER OF OBSERVATIONS=	29

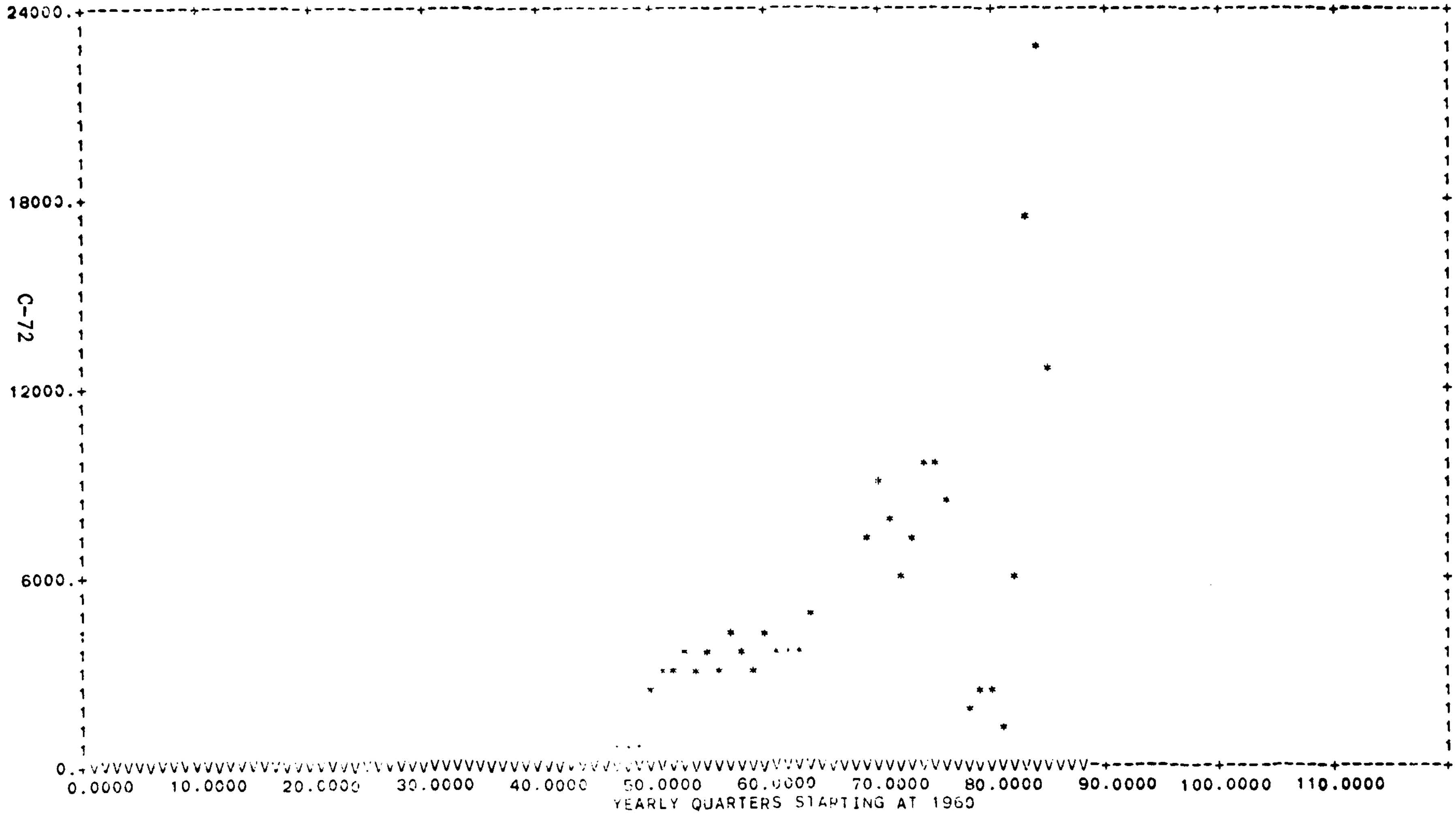
SYSTEM=UH-1
YVARIABLE=

STANDARD DEVIATION OF AVAILABILITY



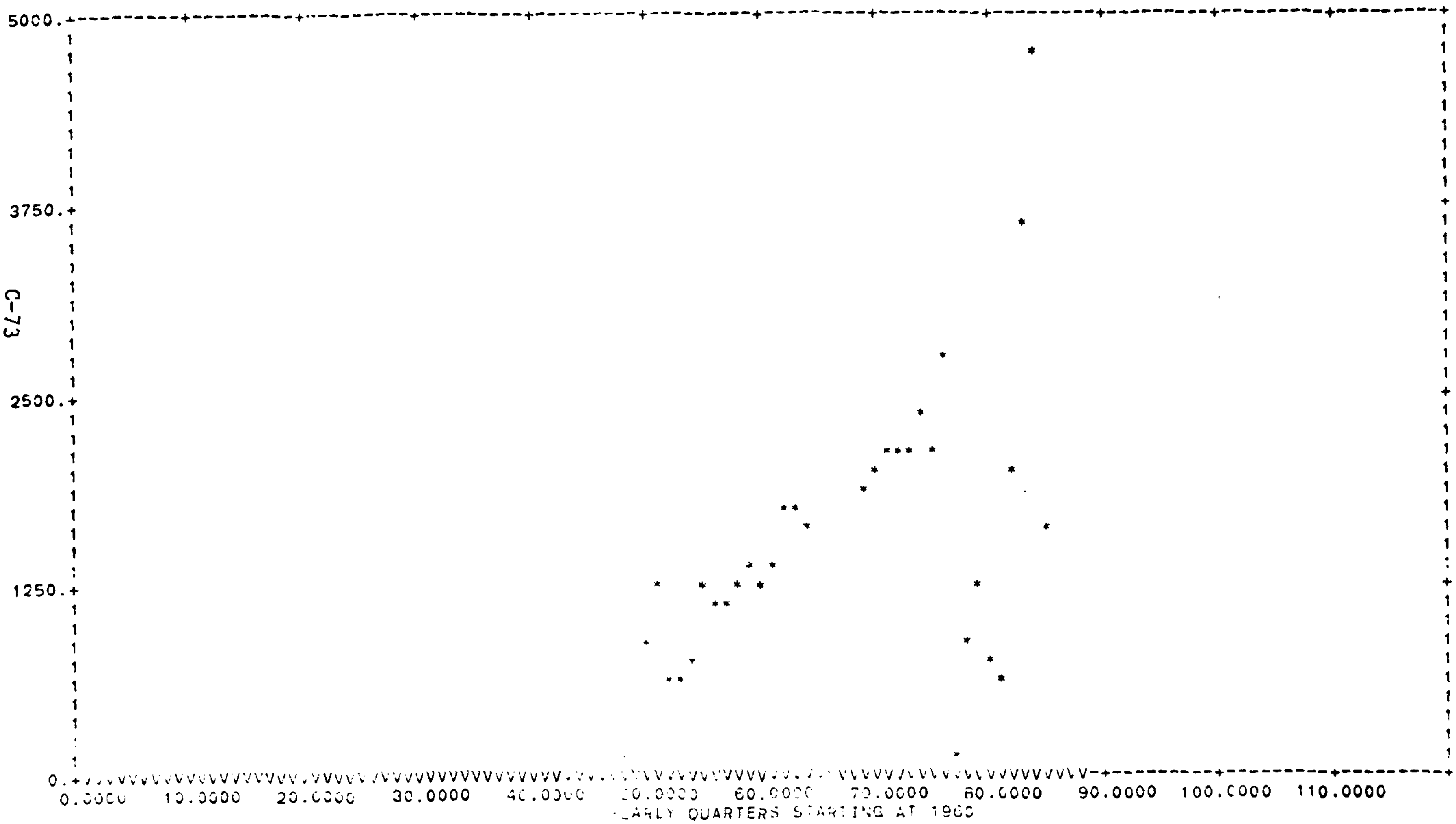
WORLDWIDE AVERAGE= .39 STANDARD DEVIATION= .1165 NUMBER OF OBSERVATIONS= 71
VIETNAM AVERAGE= .25 STANDARD DEVIATION= .0535 NUMBER OF OBSERVATIONS= 30

SYSTEM=AH-1
YVARIABLE= NUMBER OF AUTOROTATIONS



WORLDWIDE AVERAGE= 5290.57 STANDARD DEVIATION= 4795.2372 NUMBER OF OBSERVATIONS= 35

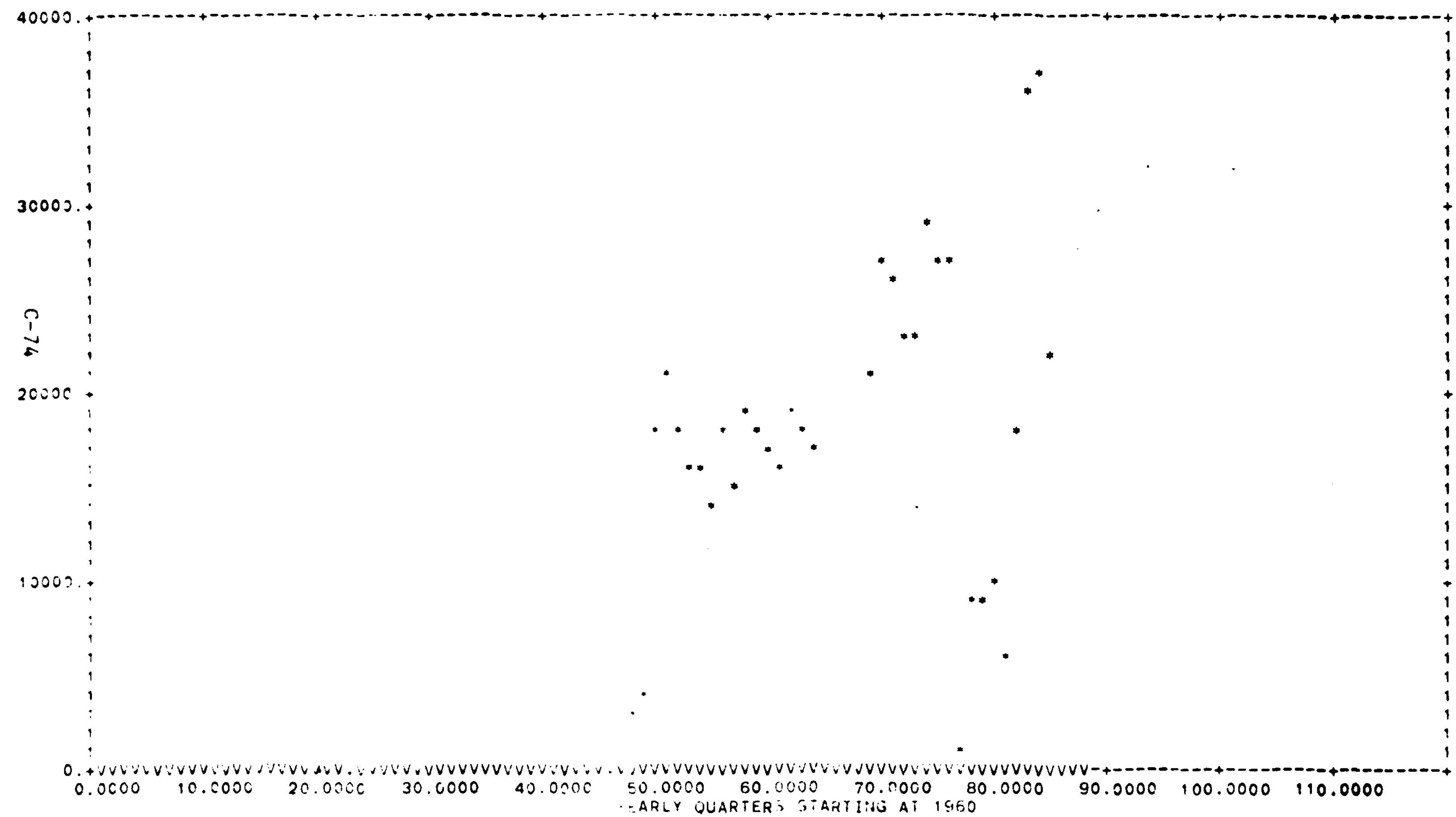
SYSTEM=CH47
YVARIABLE=   NUMBER OF AUTOROTATIONS



WORLDWIDE AVERAGE= 1454.37   STANDARD DEVIATION= 975.3699   NUMBER OF OBSERVATIONS= 35

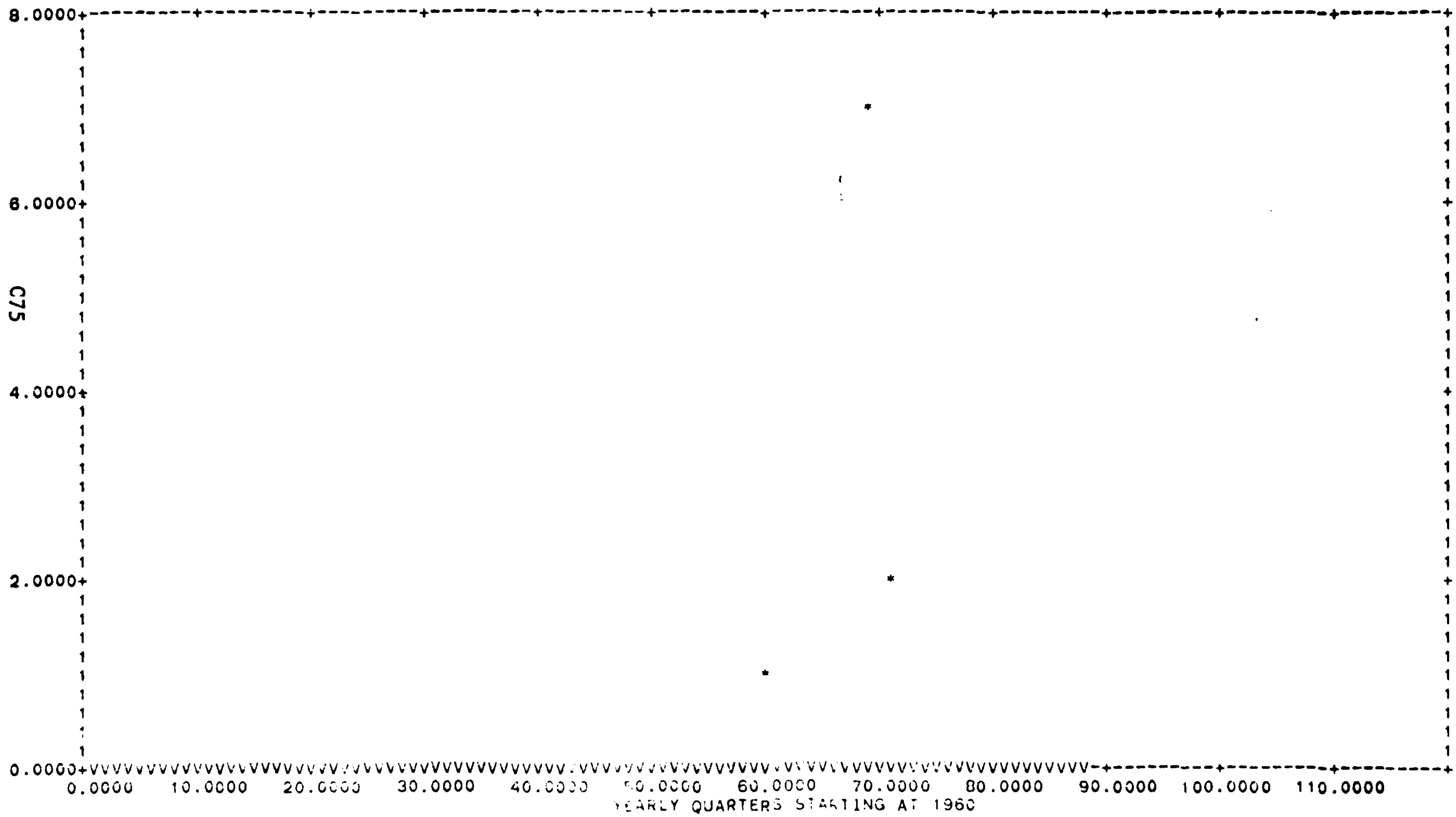
SYSTEM=OH58
YVARIABLE-

NUMBER OF A... ...TATIONS



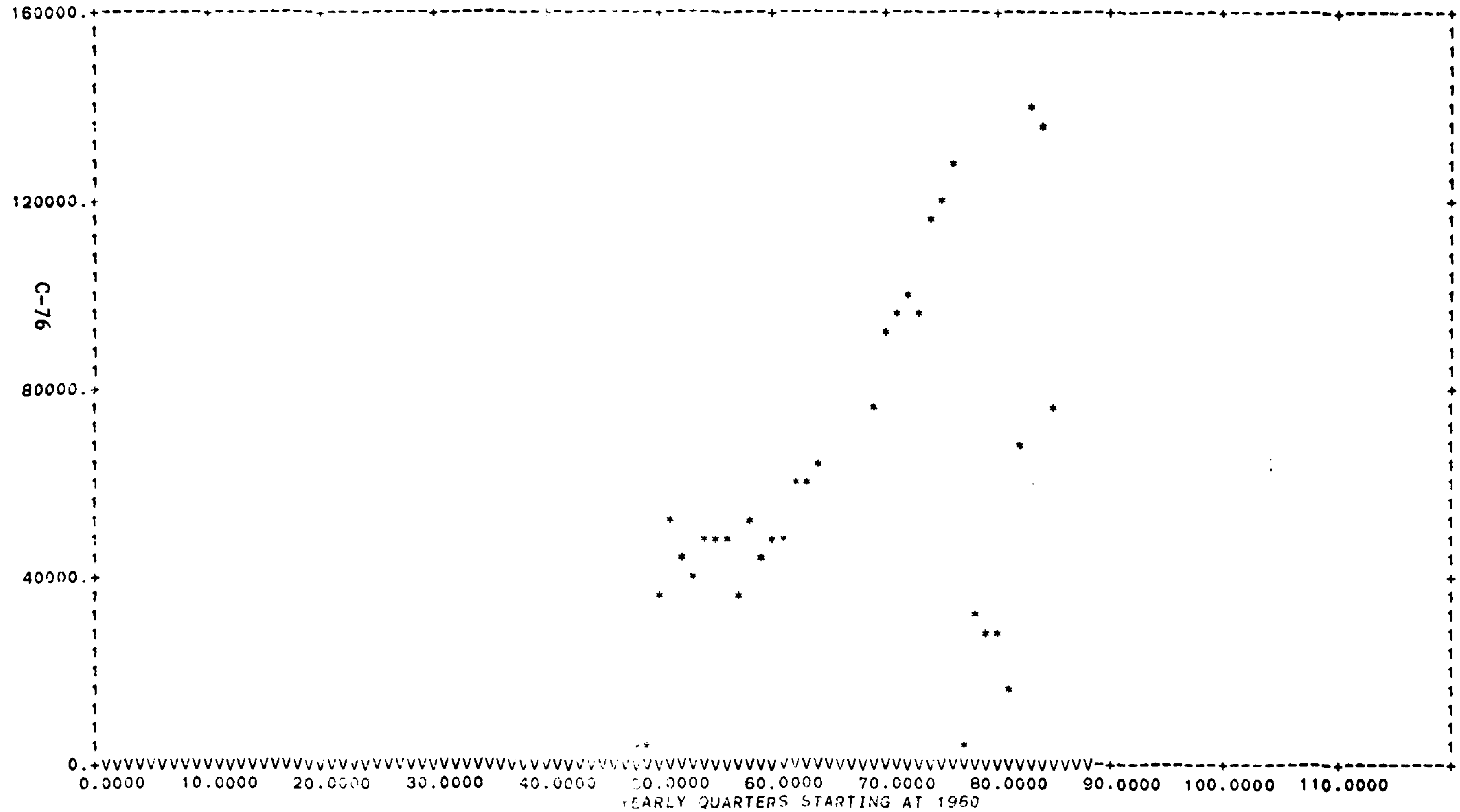
WORLDWIDE AVERAGE= 17710.63 STANDARD DEVIATION= 8827.8916 NUMBER OF OBSERVATIONS= 35

SYSTEM=OV-1
YVARIABLE= NUMBER OF AUTOROTATIONS



WORLDWIDE AVERAGE= 3.33 STANDARD DEVIATION= 3.2146 NUMBER OF OBSERVATIONS= 3

SYSTEM=UH-1
YVARIABLE= NUMBER OF AUTHORIZATIONS



WORLDWIDE AVERAGE= 60120.26 STANDARD DEVIATION= 38414.2533 NUMBER OF OBSERVATIONS= 35

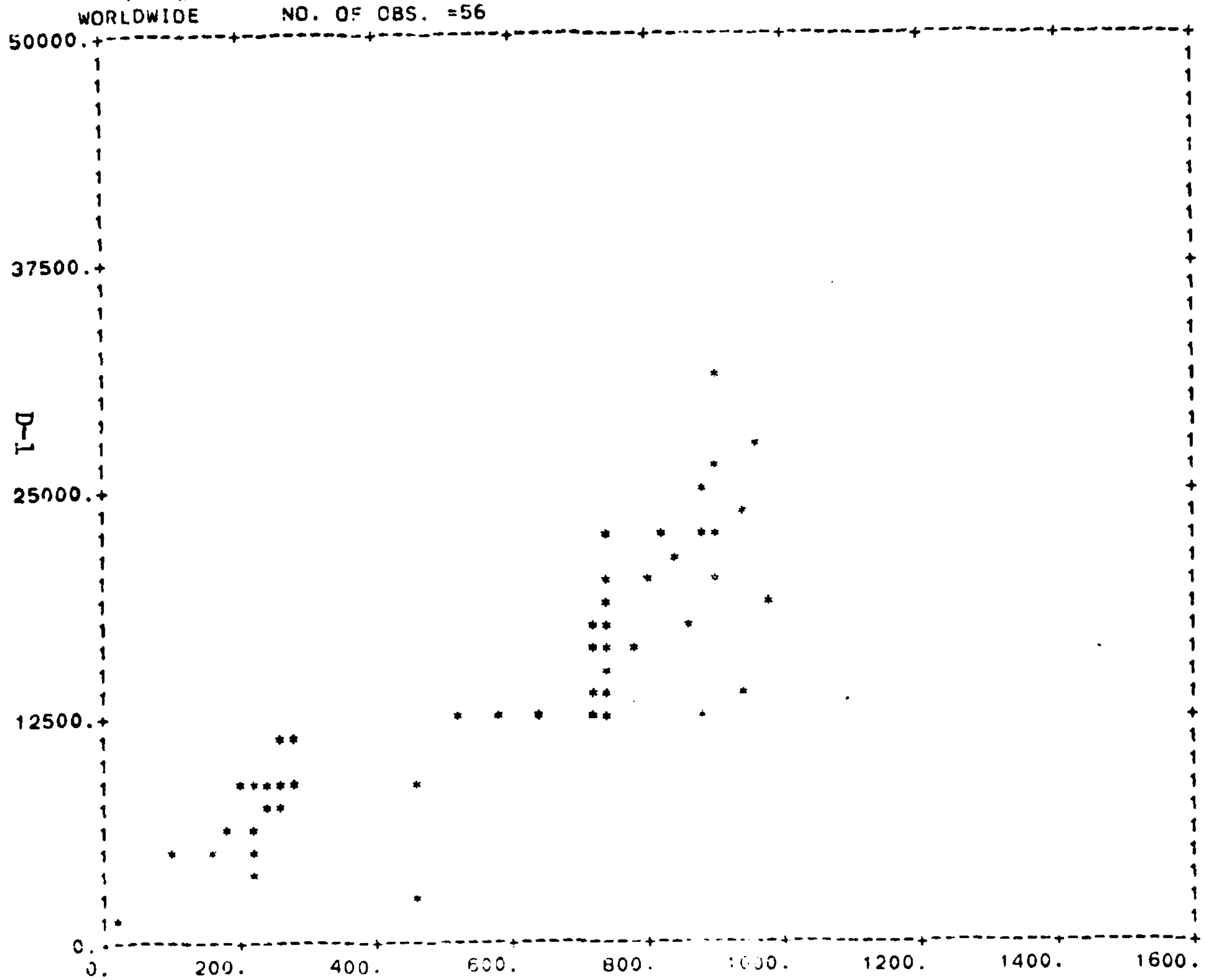
APPENDIX D

1352 PROGRAM DATA

REGRESSION ANALYSIS

Y VARIABLE (DEPENDENT)	X VARIABLE (INDEPENDENT)
TOTAL FLYING HOURS	DENSITY
TOTAL NUMBER OF SORTIES	TOTAL FLYING HOURS

SYSTEM=AH-1
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
WORLDWIDE NO. OF OBS. =56

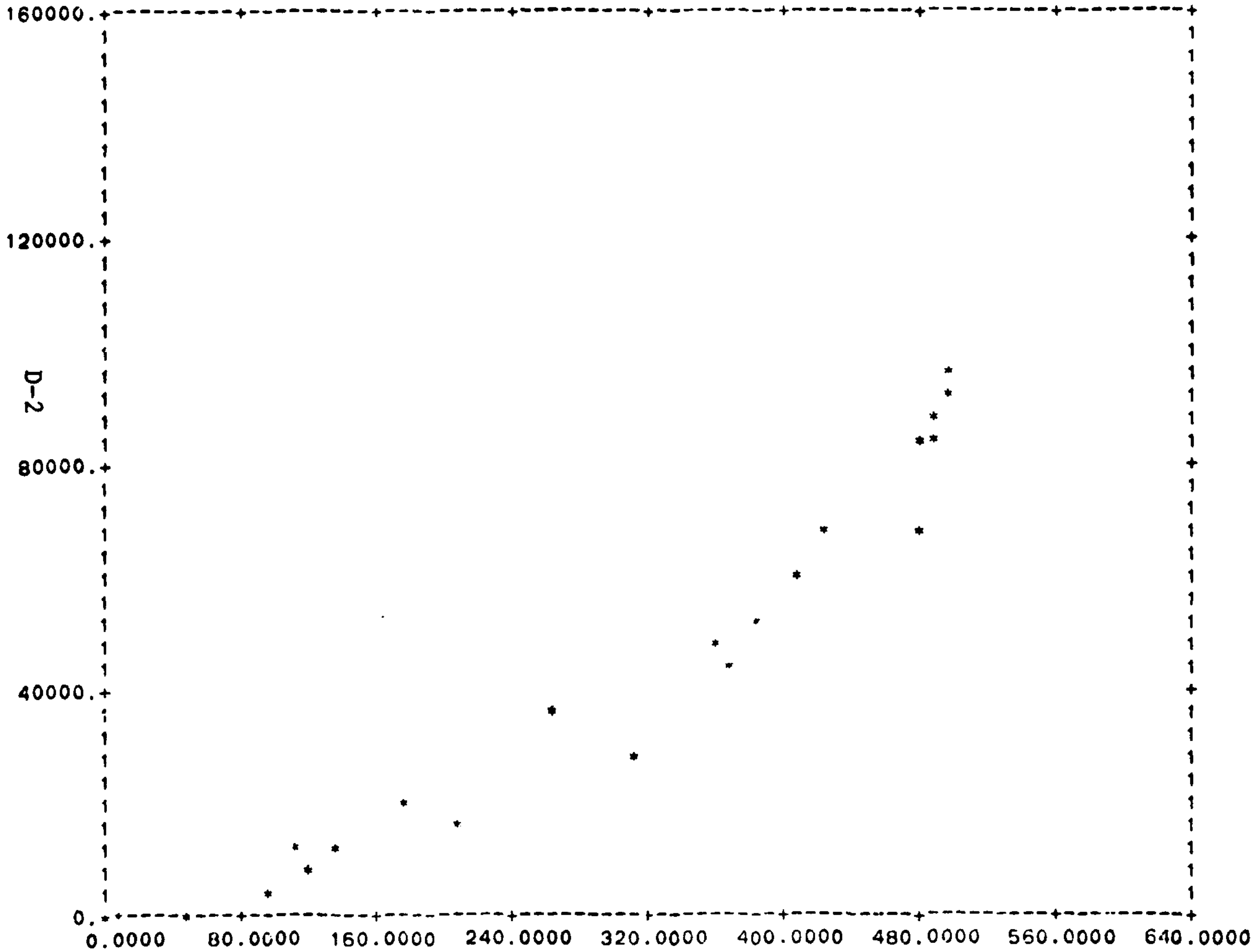


ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  1.28359344806E+10   MS=  1.28359344806E+10
RESIDUAL     DF=  55.  SS=  681843642.9419      MS=  12393520.78076
TOTAL        DF=  56.  SS=  1.3517578091E+10
F-TEST=  1035.697173951
R**2=  94.957353762984    S=  3520.443264812   CORR COEF=  .9720762456144
B(1) EST=  23.33863107702
```

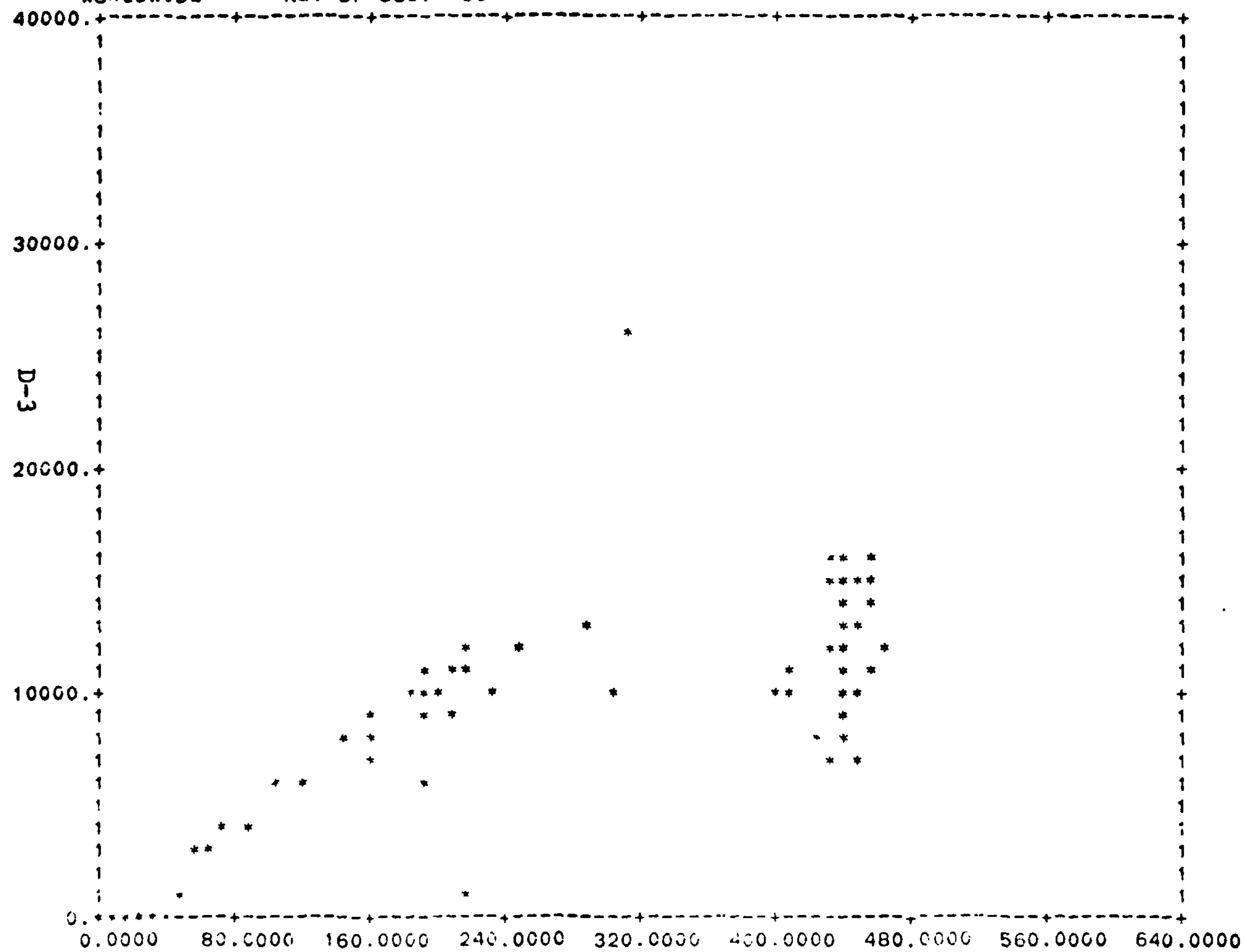
D-1

```
SYSTEM=AH-1
     YVARIABLE=                    TOTAL FLYING HOURS
     XVARIABLE=                    DENSITY
    VIETNAM    NO. OF OBS. =23
```



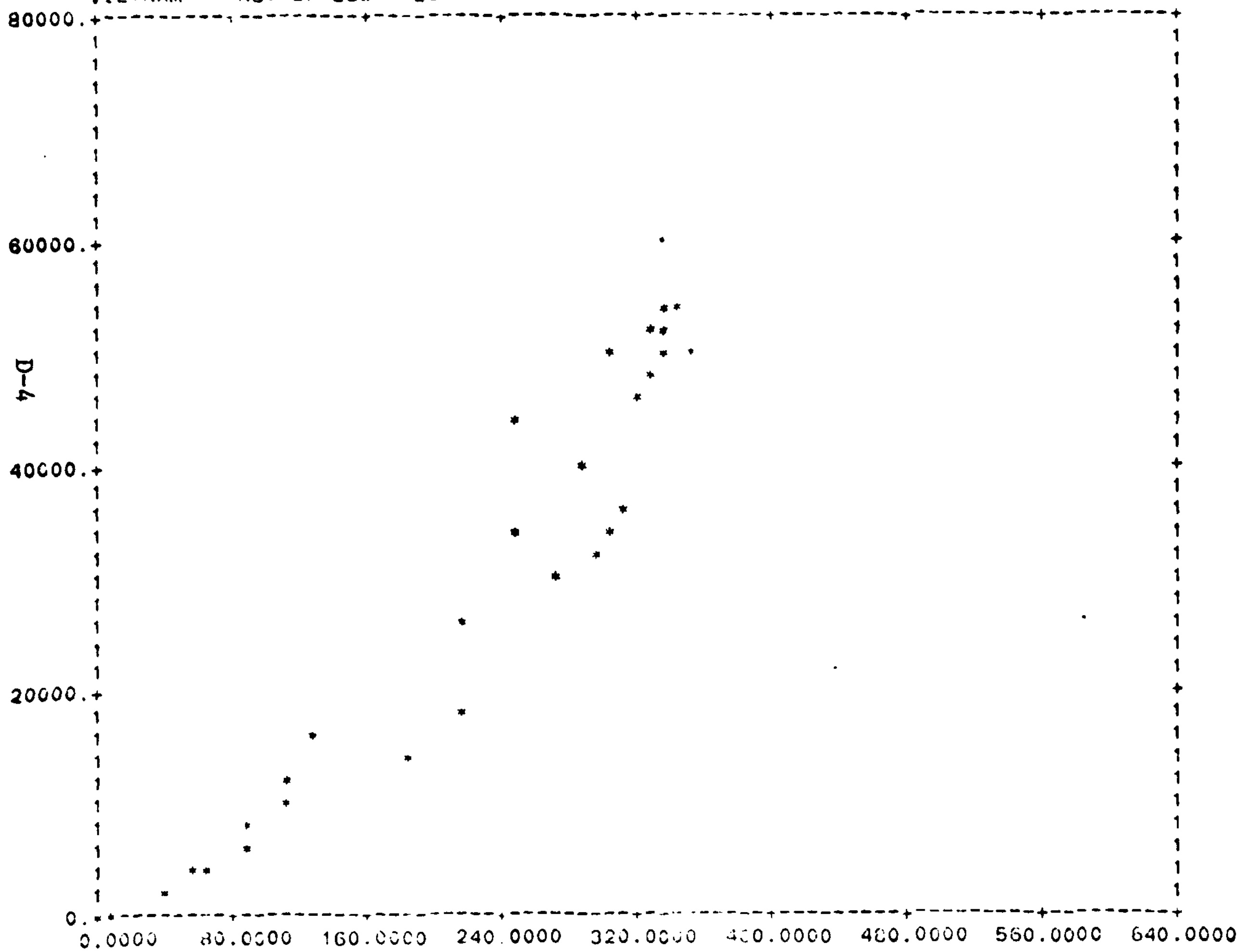

```
    ANOVA TABLE
REGRESSION     DF=   1.    SS=   7.163760068865E+10   MS=   7.163760068865E+10
RESIDUAL       DF=  22.    SS=   2.552751319349E+9    MS=   116034150.8795
TOTAL          DF=  23.    SS=   7.4190352008E+10
F-TEST=   617.3837628463
R**2=   96.55918694243     S=   10771.91491238   CORR EST=   .9648550432936
B(1) EST=   156.268830561
```

```
SYSTEM=CH47
     YVARIABLE=                     TOTAL FLYING HOURS
     XVARIABLE=                     DENSITY
   WORLDWIDE      NO. OF OBS. =66
```




```
   ANOVA TABLE
REGRESSION     DF=   1.   SS=   7.607059179486E+9   MS=   7.607059179486E+9
RESIDUAL       DF=  65.   SS=   904314688.5144      MS=   13912533.66945
TOTAL          DF=  66.   SS=   8.511373868E+9
F-TEST=   546.7774138213
R**2=   89.37522070421      S=   3729.950893705   CORR EST=  .6474563932268
B(1) EST=   30.85705836895
```

SYSTEM C-47
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
VIETNAM NO. OF OBS. =28



ANOVA TABLE

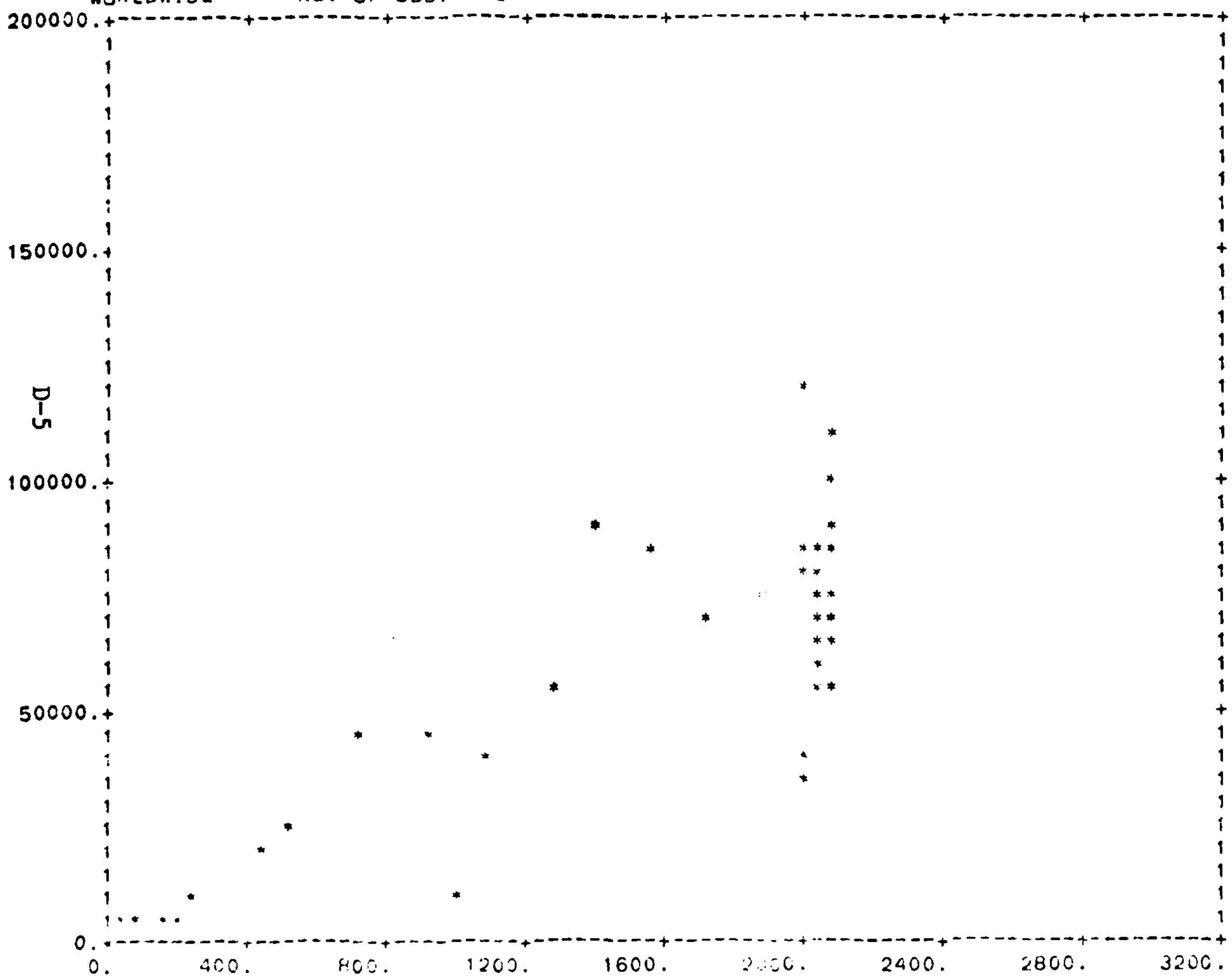
REGRESSION	DF=	1.	SS=	3.6547758750195E+10	MS=	3.6547758750195E+10
RESIDUAL	DF=	27.	SS=	1.201244086814E+9	MS=	44490521.73387
TOTAL	DF=	28.	SS=	3.7749002837E+10		

F-TEST= 821.4729188569

R**2= 96.81781240156 S= 6670.121568148 CORR EST= .9549990969963

B(1) EST= 140.5169801332

SYSTEM=OH58
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
WORLDWIDE NO. OF OBS. =48

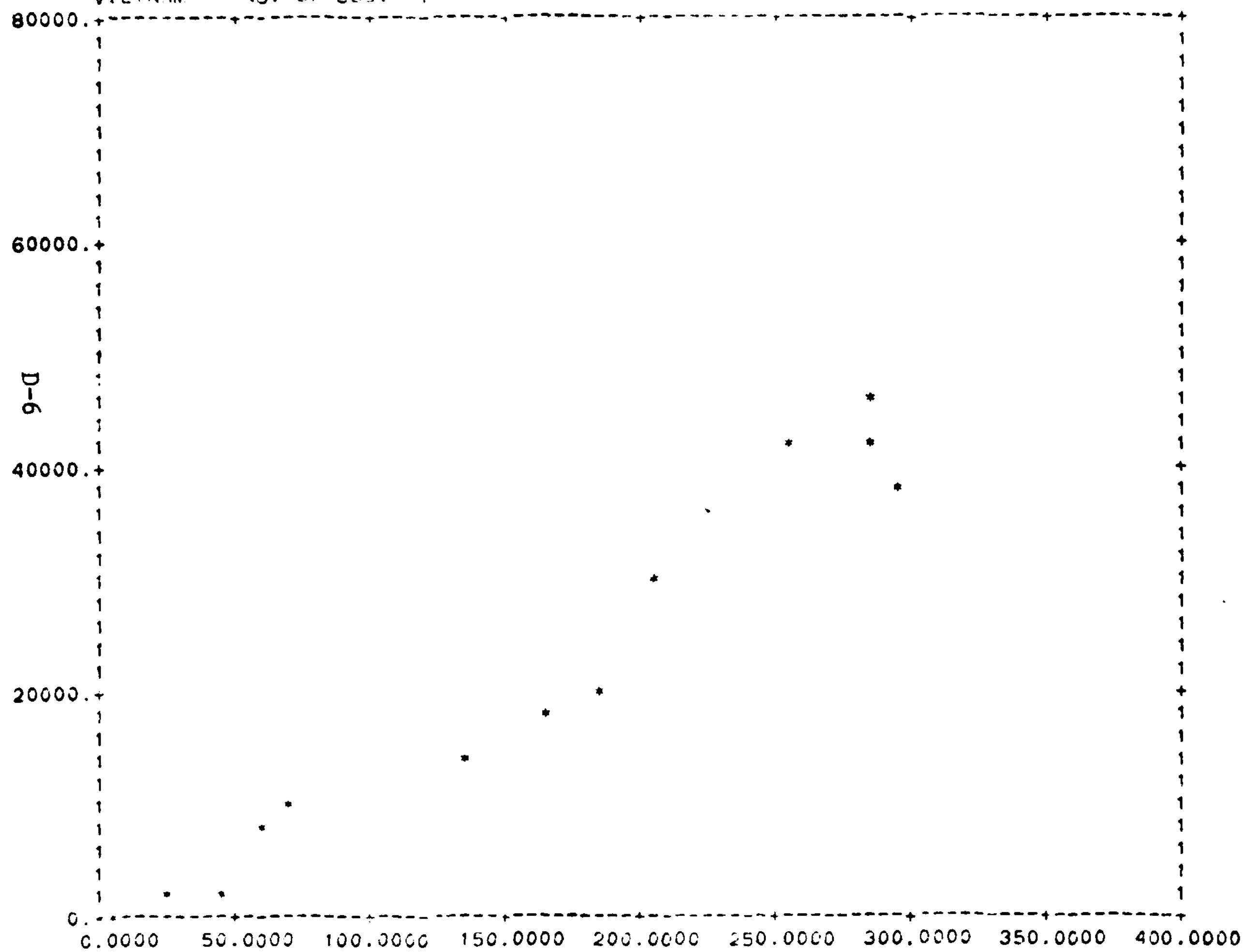


ANOVA TABLE

REGRESSION	DF=	1.	SS=	2.0852833250204E+11	MS=	2.0852833250204E+11
RESIDUAL	DF=	47.	SS=	1.414008316862E+10	MS=	300852833.3749
TOTAL	DF=	48.	SS=	2.2266840818 9E+11		

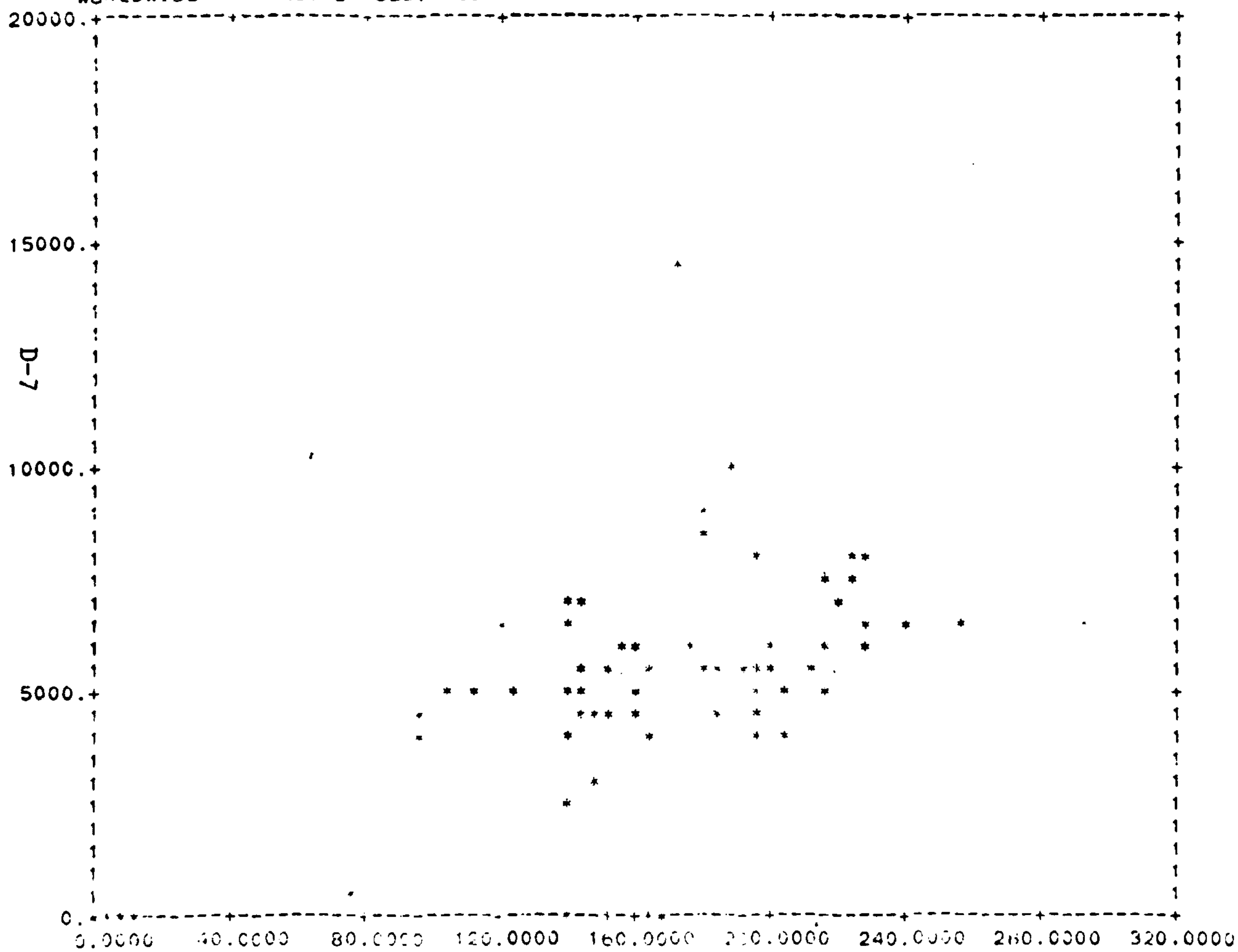
F-TEST= 693.1240130799
R**2= 93.6497[illegible] S= 17345.10978273 COEF [illegible] .82784095[illegible]
B(1) EST= [illegible].617866[illegible]

```
SYSTEM=CH53
     YVARIABLE=                    TOTAL FLYING HOURS
     XVARIABLE=                   DENSITY
   VIETNAM    NO. OF OBS. =14
```



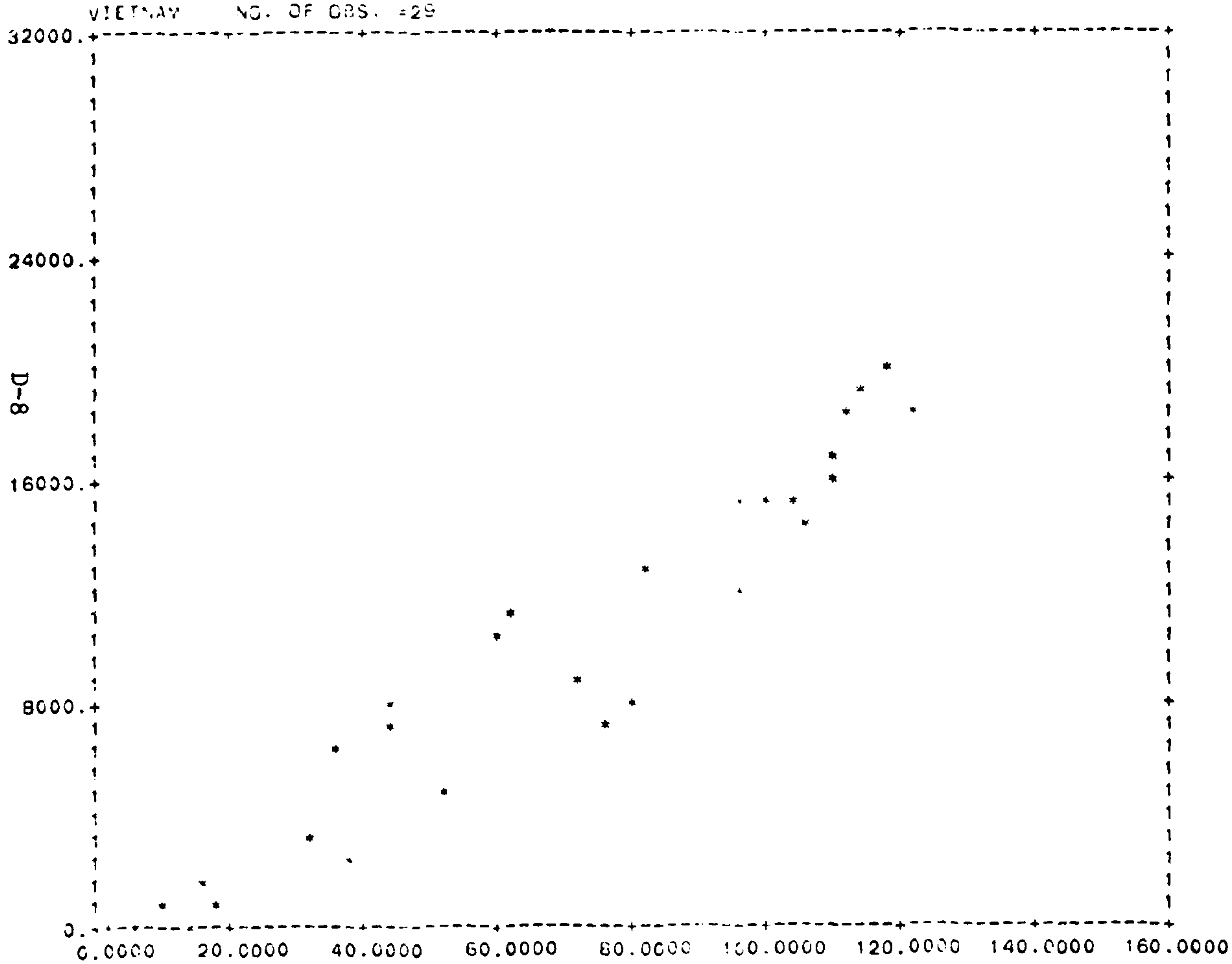

```
    ANOVA TABLE
REGRESSION    DF=   1.   SS=   1.015602400786E+10   MS=   1.015602400786E+10
RESIDUAL      DF=  13.   SS=   232598926.141   MS=   17892225.08777
TOTAL         DF=  14.   SS=   1.039862293 4E+10
F-TEST=   567.6221910936
R**2=   97.76102253765   S=   4229.920222388   CORR EST=   .9733678581256
B(1) EST=   143.2509228895
```

SYSTEM=OV-1
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
WORLDWIDE NO. OF OBS. =65



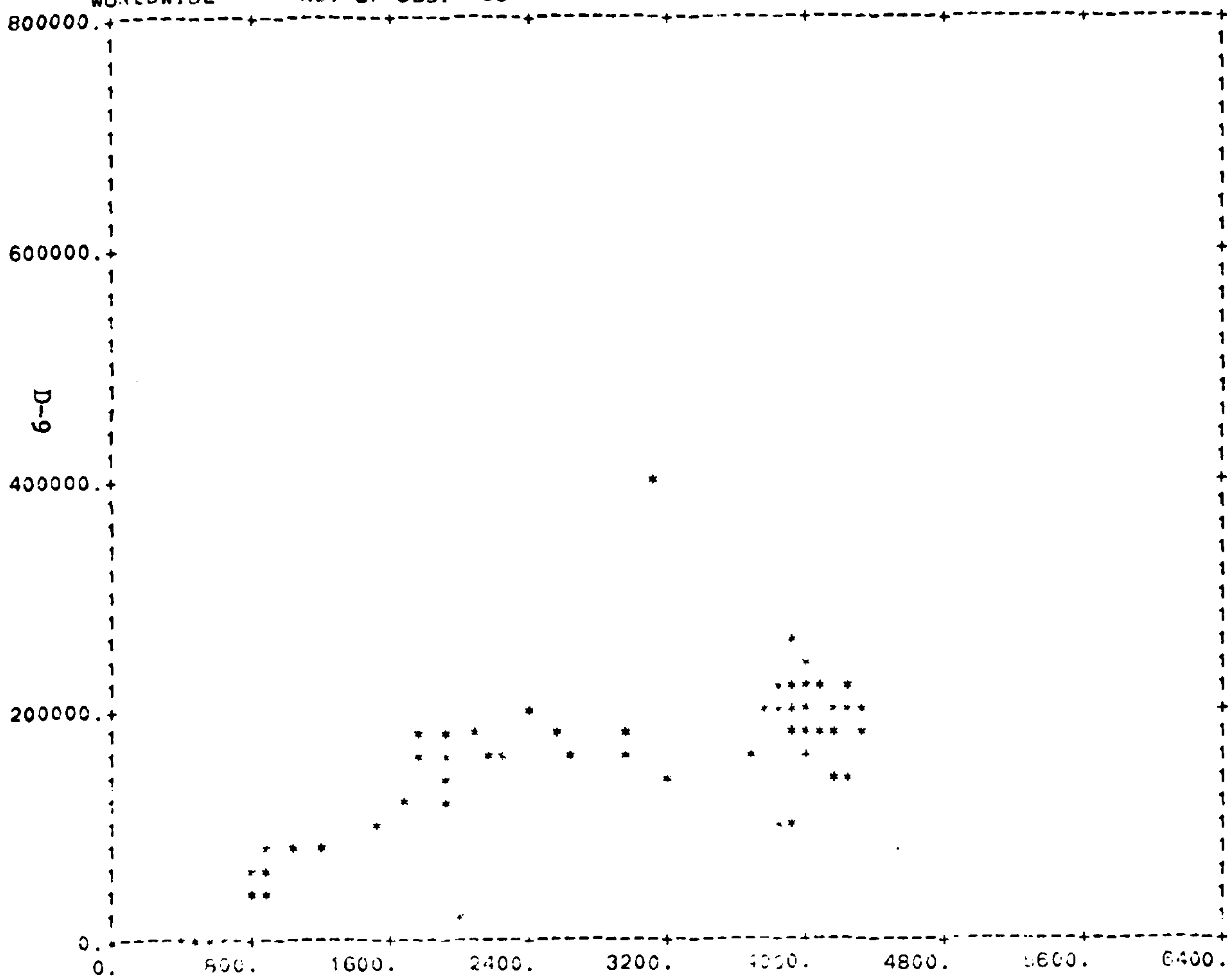
ANOVA TABLE
REGRESSION DF= 1. SS= 2.122594698126E+9 MS= 2.122594698126E+9
RESIDUAL DF= 64. SS= 211561676.8741 MS= 3305651.23240
TOTAL DF= 65. SS= 2.334156377E+9
F-TEST= 642.1102230052
R**2= 90.9362683276 S= 1818.1449976
B(1) EST= 32.1123094262

```
SYSTEM=OV-1
     Y-VARIABLE=                    TOTAL FLYING HOURS
     X-VARIABLE=                   DENSITY
   VIETNAM     NO. OF OBS. =29
```



```
     ANOVA TABLE
REGRESSION      DF=    1.    SS=   3.993349905294E+9   MS=   3.993349905294E+9
RESIDUAL        DF=   28.    SS=   95317742.70572   MS=   3404205.096633
TOTAL           DF=   29.    SS=   4.09466764BE+9
F-TEST=   1174.826366734
R**2=   97.67214946609      S=   1845.04880603   CORR EST=   .9557291223106
B(1) EST=   150.1114685748
```

SYSTEM=UH-1
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
WORLDWIDE NO. OF OBS. =65

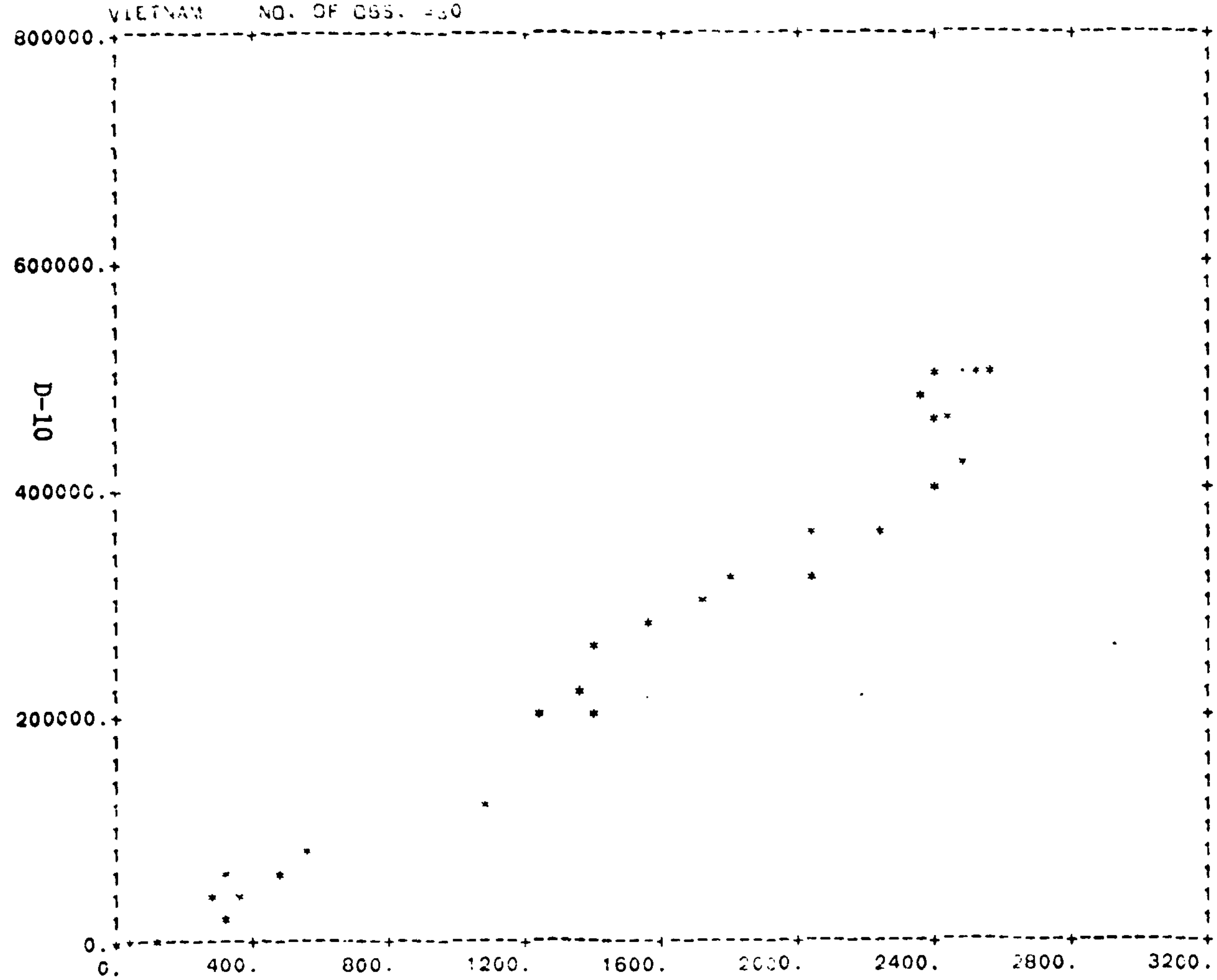


ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  1.857368874739E+12   MS=  1.85738687473 E+12
RESIDUAL     DF=  64.  SS=  1.78335852579UE+11   MS=  2.786E1557155E+9
TOTAL        DF=  65.  SS=  2.035922527319E+12
F-TEST=  666.820850154
R**2=  91.2307246379    S=  52816.64031493   CORR EST=  .612500558[illegible]107
B(1) EST=  51.4954783159
```

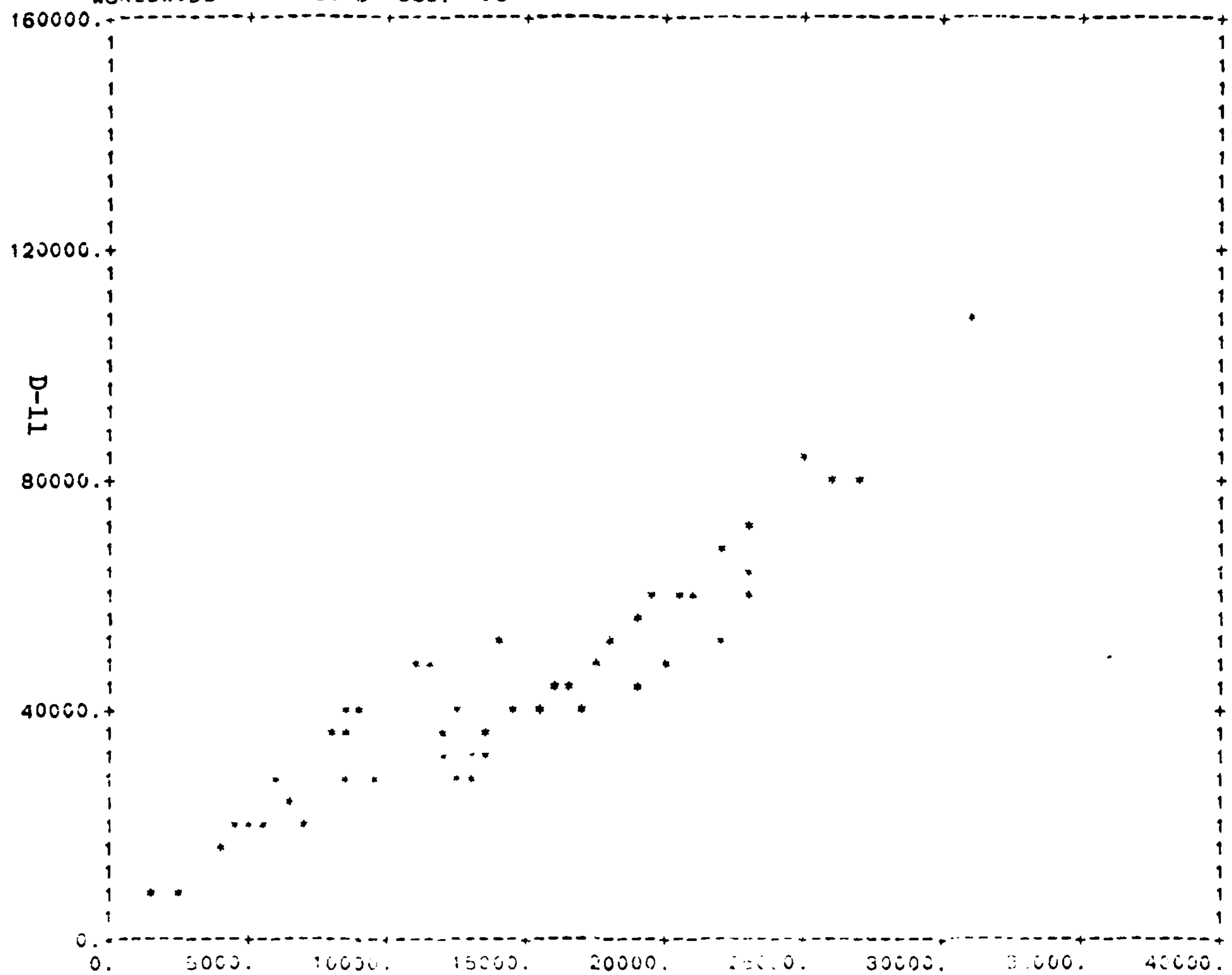
D-9

SYSTEM=UH-1
YVARIABLE= TOTAL FLYING HOURS
XVARIABLE= DENSITY
VIETNAM NO. OF OBS. =30



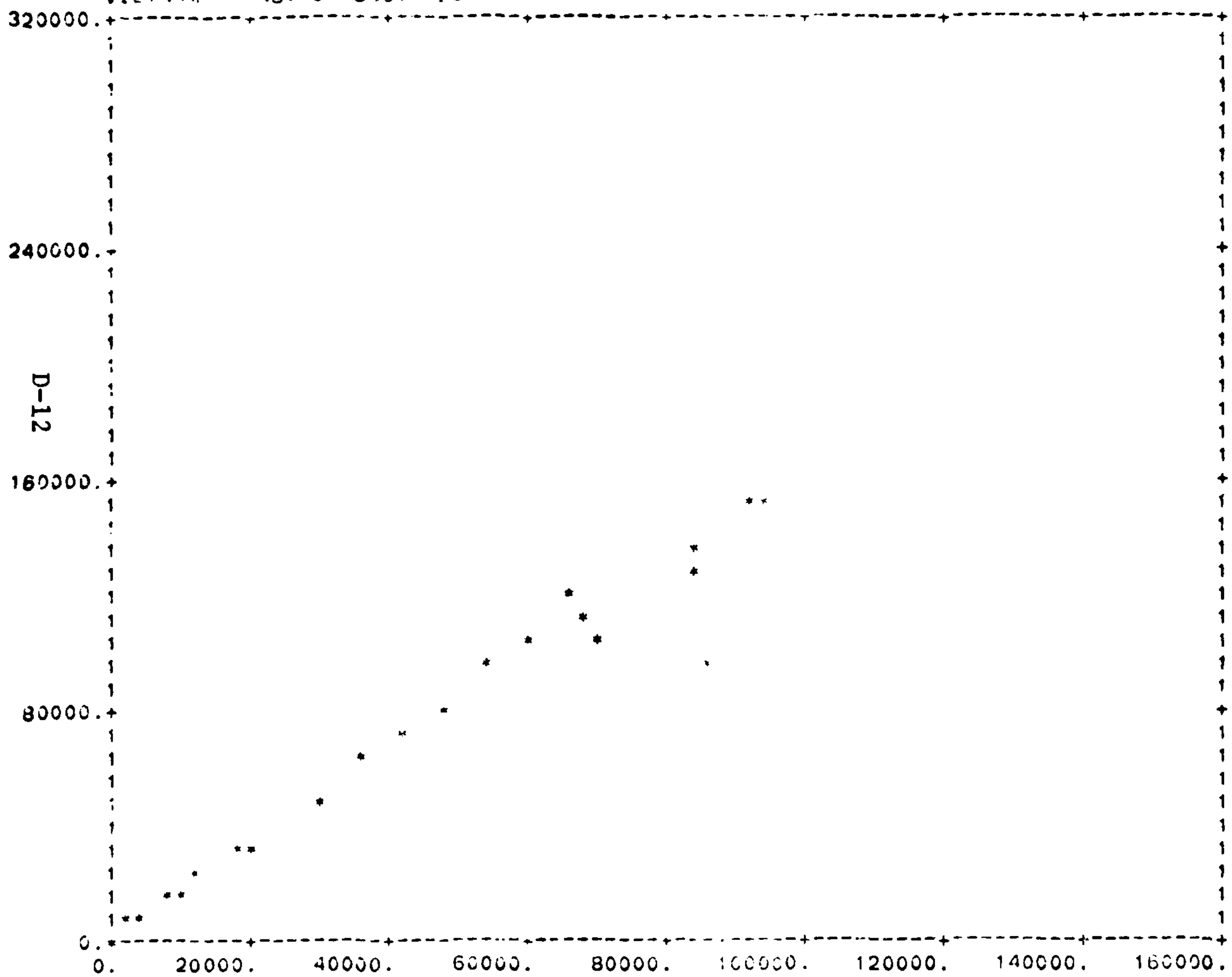

```
ANOVA TABLE
REGRESSION   DF=  1.   SS=  3.47129776694E+12   MS=  3.47129776694E+12
RESIDUAL     DF=  29.  SS=  4.041274547978E+10  MS=  1.393542947579E+9
TOTAL        DF=  30.  SS=  3.51171051242E+12
F-TEST=  2490.987287454
R**2=  98.84920054381    S=  37330.18815354   CORR EST=  .9939467562707
B(1) EST=  182.3761934004
```

```
SYSTEM=AH-1
     YVARIABLE=                    TOTAL NUMBER OF SORTIES
     XVARIABLE=                    TOTAL FLYING HOURS
   WORLDWIDE        NO. OF OBS. =55
```




```
ANOVA TABLE
REGRESSION    DF=   1.   SS=  1.15480828919E+11   MS=  1.15480828919E+11
RESIDUAL      DF=  54.   SS=  3.233734970025E+9   MS=  59885092.05751
TOTAL         DF=  55.   SS=  1.18720563889E+11
F-TEST=   1924.837
R**2=   97.27                 S=   7745.549878319   CORR COEF=  .9863874041324
B(1) EST=   2
```

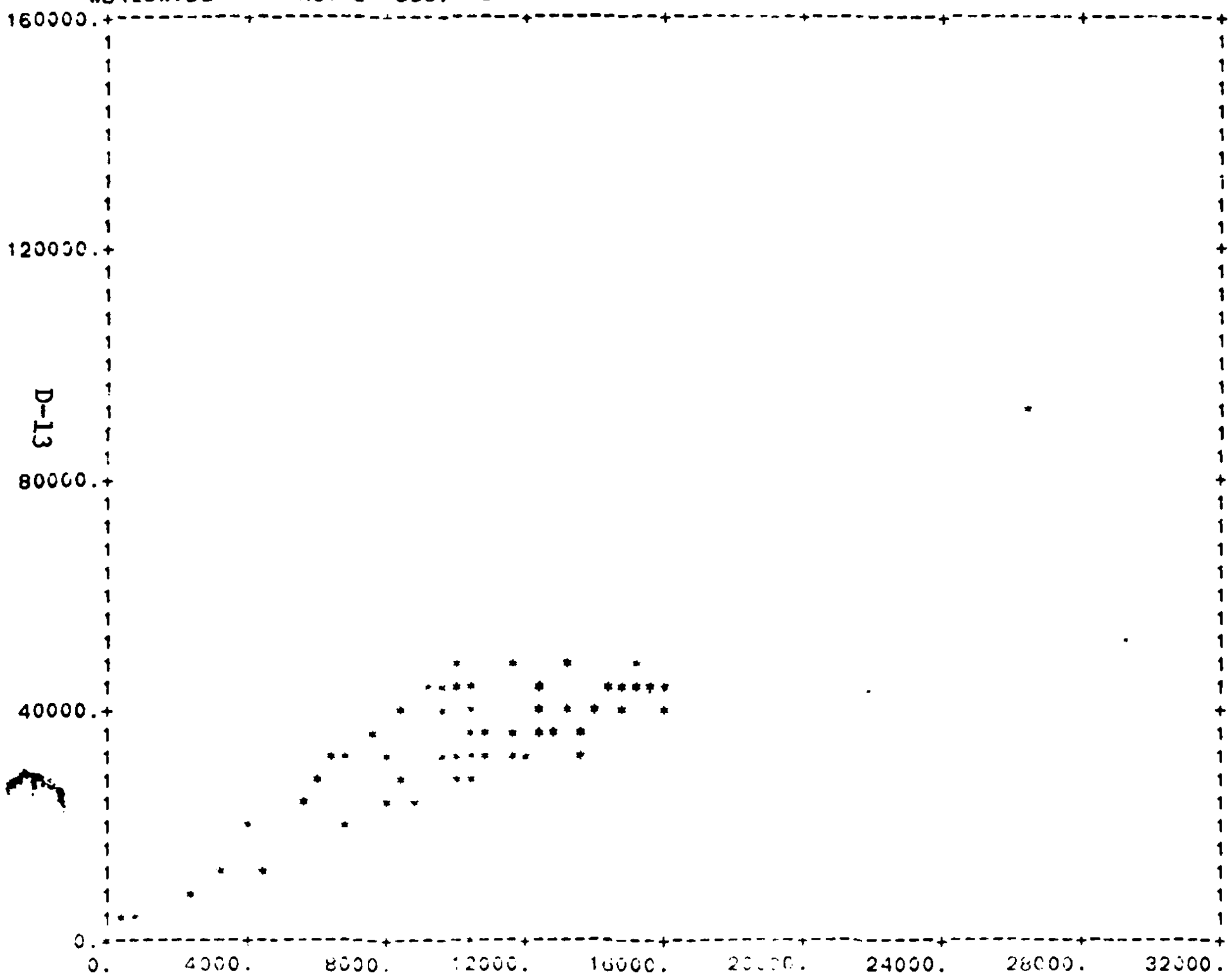
SYSTEM=AH-1
YVARIABLE= TOTAL NUMBER OF SORTIES
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =22



ANOVA TABLE

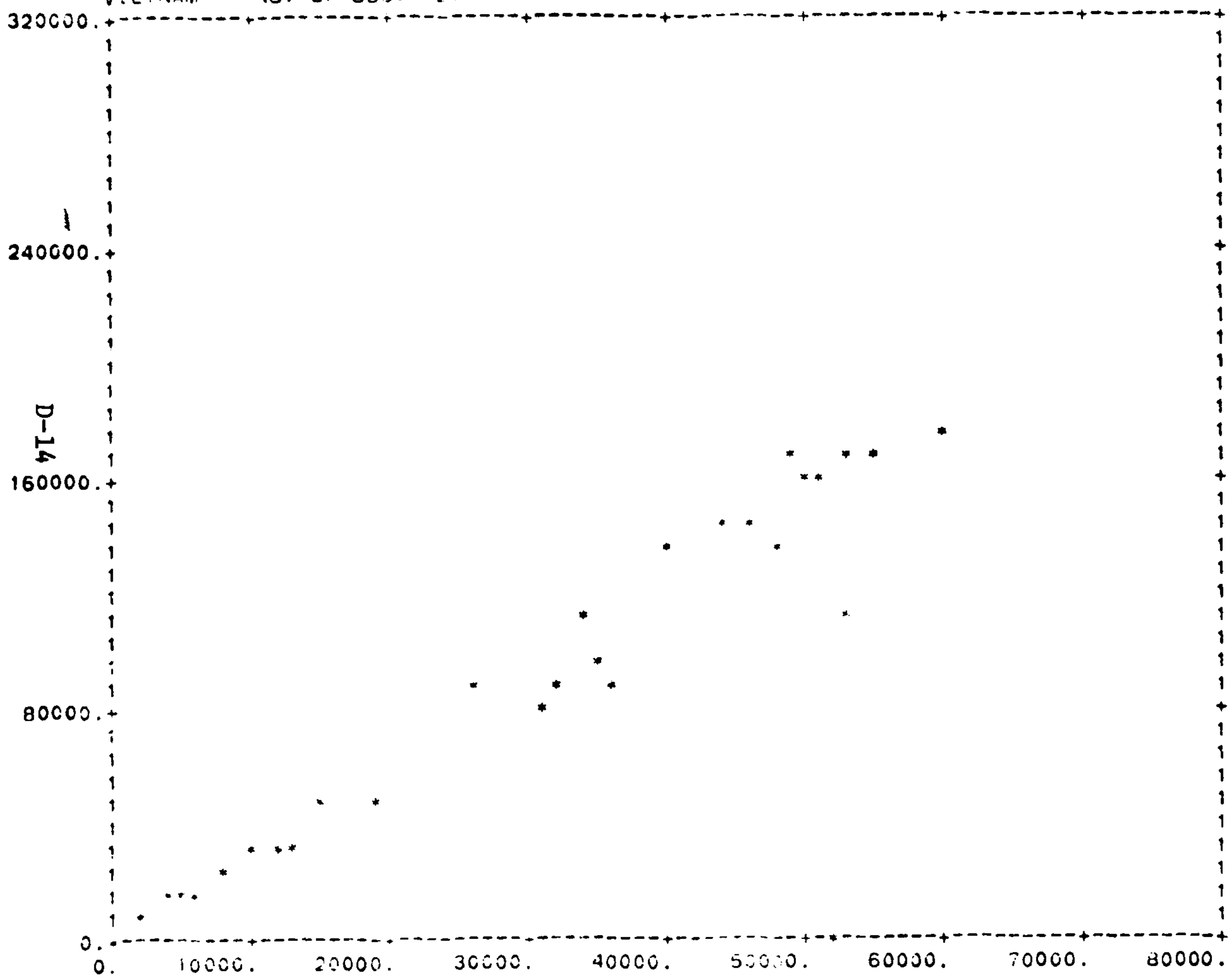
REGRESSION DF= 1. SS= 1.665550778453E+11 MS= 1.665550778453E+11
RESIDUAL DF= 21. SS= 2.404688421736E+9 MS= 114508972.4636
TOTAL DF= 22. SS= 1.68959766267E+11
F-TEST= 1454.515521901
R**2= 98.57676861468 S= 10700.886527 CORR EST= .9787252218415
B(1) EST= 1.583709173628

```
SYSTEM=CH47
      YVARIABLE=                    TOTAL NUMBER OF SORTIES
      XVARIABLE=                    TOTAL FLYING HOURS
   WORLDWIDE        NO. OF OBS. =64
```




```
   ANOVA TABLE
REGRESSION    DF=   1.   SS=  8.7[illegible]4604186[illegible]E+10   MS=  8.7084604[illegible]611E+10
RESIDUAL      DF=  63.   SS=  2.99[illegible]0922[illegible]E+9    VS=  47530305.1093
TOTAL         DF=  64.   SS=  [illegible]0134080E+10
F-TEST=   1832.[illegible]45952
R**2=   [illegible]        S=  [illegible].2225891[illegible]  COR [illegible]  .86[illegible]7190774[illegible]
S(1) EST=   [illegible]21935585[illegible]82[illegible]
```

SYSTEM=CH47
YVARIABLE= TOTAL NUMBER OF SORTIES
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =27



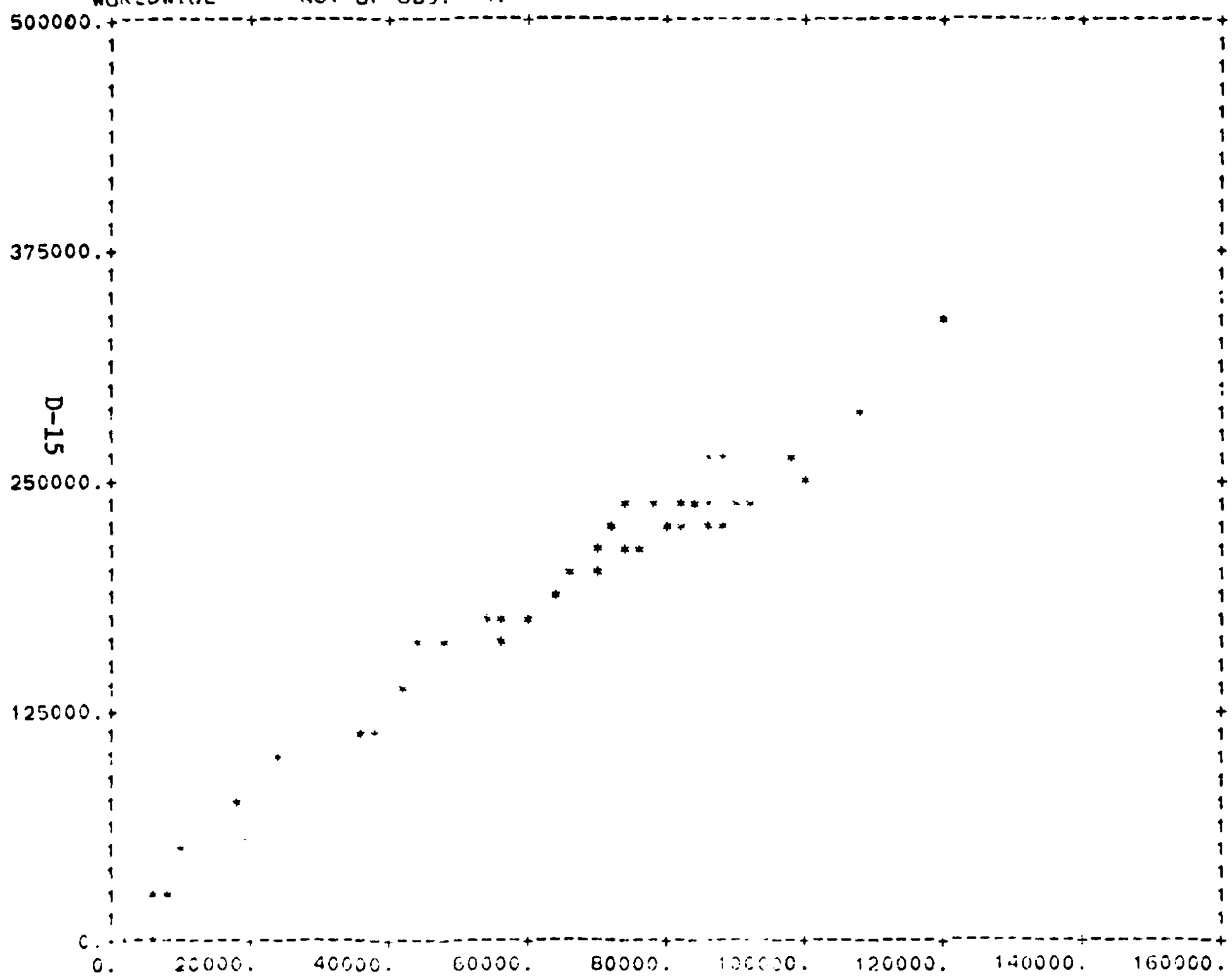
ANOVA TABLE

REGRESSION	DF=	1.	SS=	3.14442630492E+11	MS=	3.14442630492E+11
RESIDUAL	DF=	26.	SS=	4.239611768973E+9	MS=	163061091.1143
TOTAL	DF=	27.	SS=	3.18[illegible]2242261E+11		

F-TEST= 1[illegible]2[illegible].3[illegible]251013
R**2= 98.[illegible]64292115 S= 12769.57286343 CORR EST= .9756337256978
B(1) EST= 2.994069915667

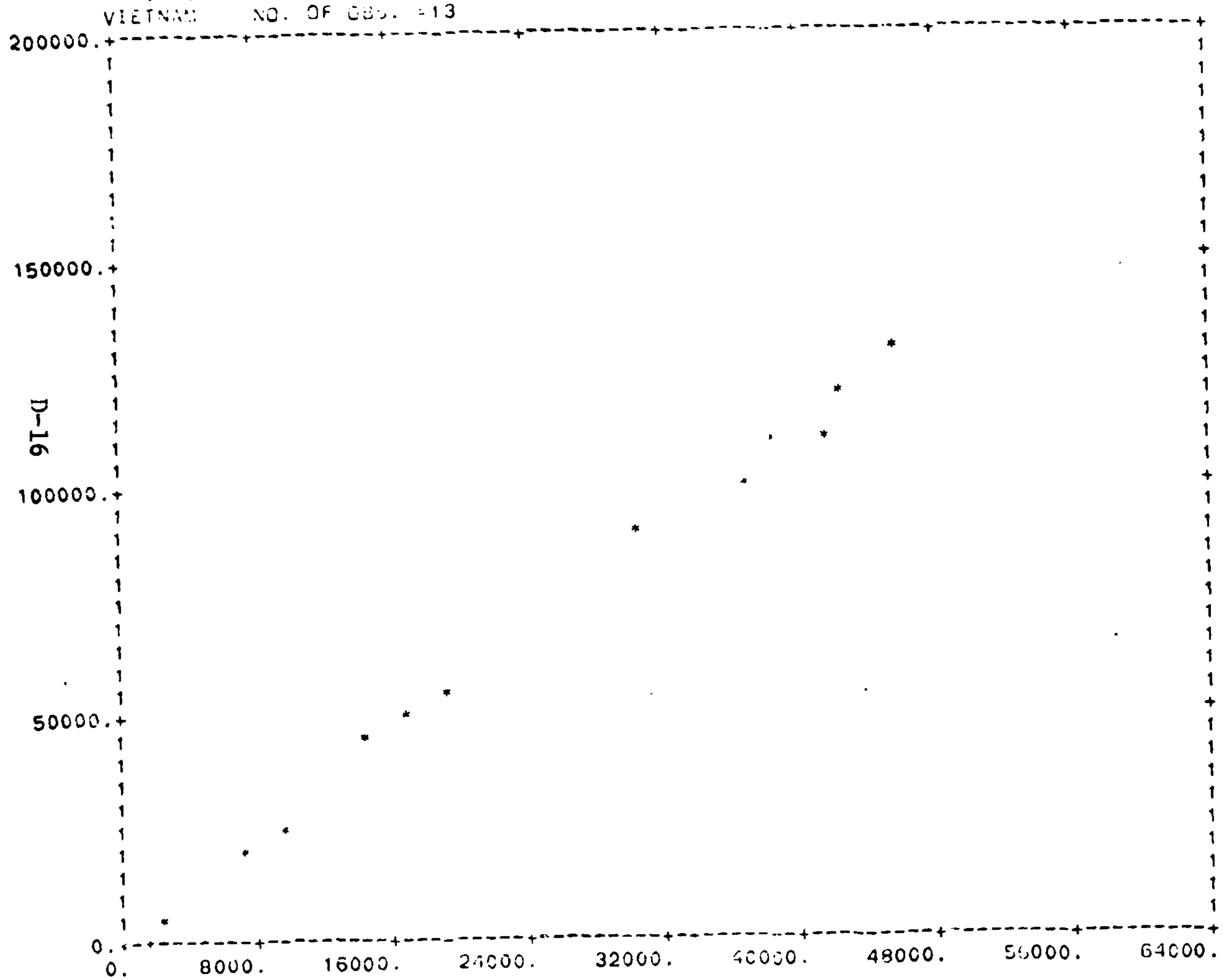
D-14

```
SYSTEM=OH58
      YVARIABLE=                     TOTAL NUMBER OF SORTIES
      XVARIABLE=                     TOTAL FLYING HOURS
   WORLDWIDE        NO. OF OBS. =47
```




```
   ANOVA TABLE
REGRESSION     DF=   1.    SS=   1.8090115074450E+12    MS=   1.8090115074455E+12
RESIDUAL       DF=   46.   SS=   1.1859385477250E+10    MS=   257812727.7563
TOTAL          DF=   47.   SS=   1.8208708929225E+12
F-TEST=   7016.765708052
R**2=   99.34 69700993       S=   16056.5478159    CORR EST=   .9985017538451
B(1) EST=   2.350504773112
```

SYSTEM=[illegible]
YVARIABLE= TOTAL NU[illegible] SORTIES
XVARIABLE= TOTAL FLYING [illegible]RS
VIETNAM NO. OF OBS. =13

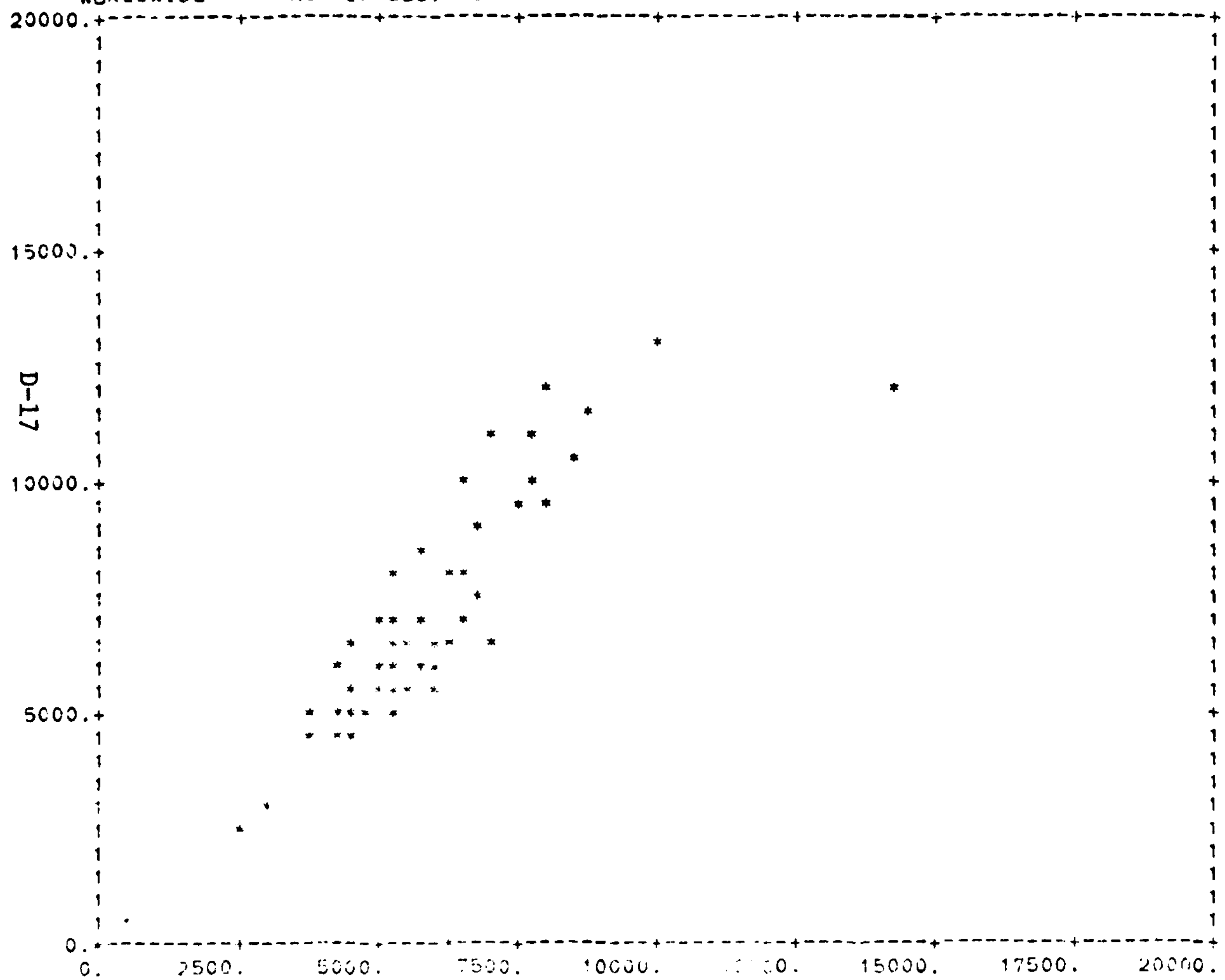


ANOVA TABLE

REGRESSION	DF=	1.	SS=	8.201810206719E+10	MS=	8.201810206719E+10
RESIDUAL	DF=	12.	SS=	101825480.812	MS=	8485456.734334
TOTAL	DF=	13.	SS=	8.2119927548E+10		

F-TEST= 9665.726269668
R**2= 99.87600393248 S= 2912.980730169 CORR EST= .9980967083891
B(1) EST= 2.810059791951

SYSTEM=OV-1
YVARIABLE= TOTAL NUMBER OF SORTIES
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =64



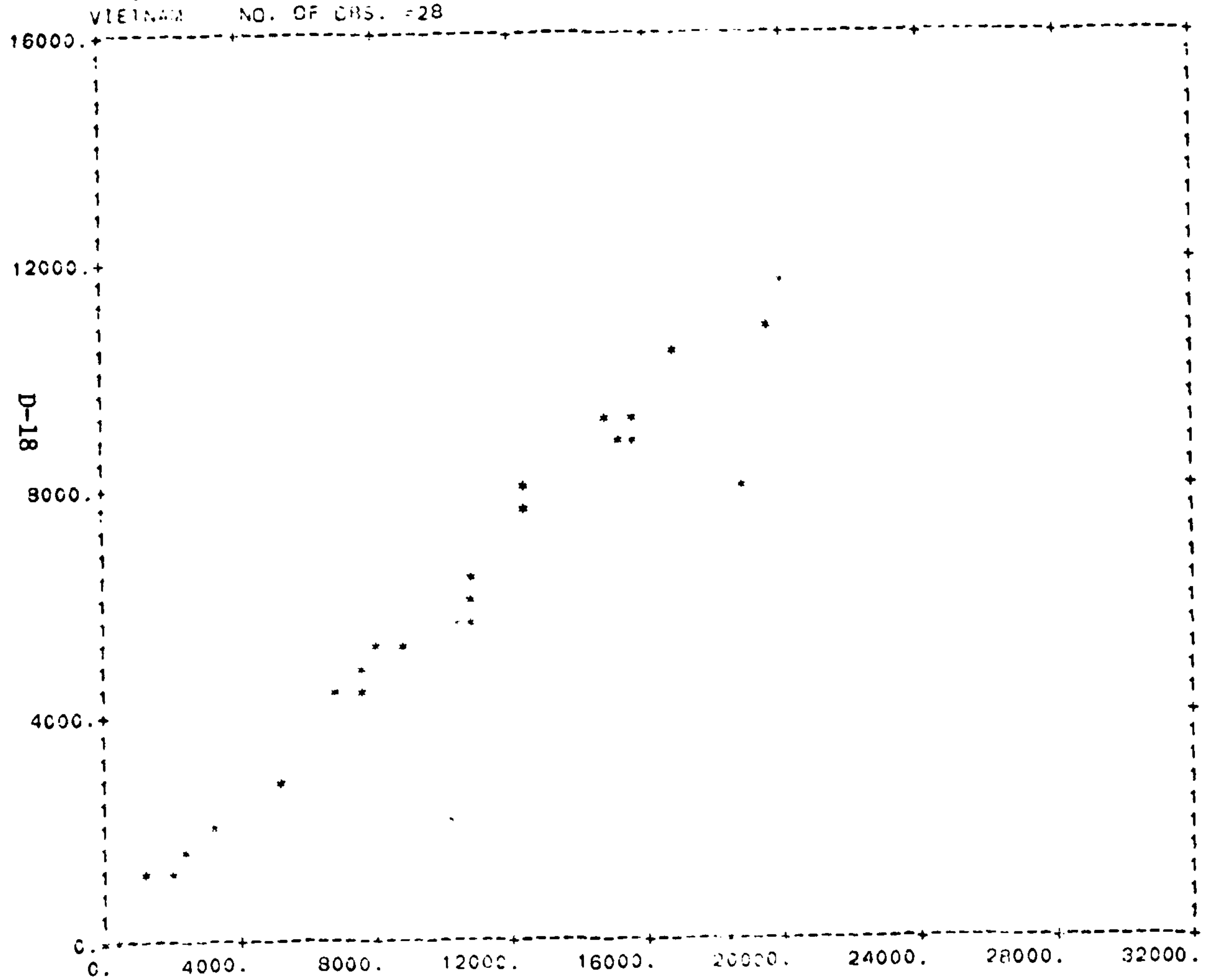

```
ANOVA TABLE
REGRESSION    DF=  1.   SS=  3.183601563758E+9   MS=  3.183601563758E+9
RESIDUAL      DF=  63.  SS=  86434604.24173      MS=  1372295.305424
TOTAL         DF=  64.  SS=  3.270056168E+9
F-TEST=  [illegible]
R**2=  [illegible]   SE=  1171.450068612   [illegible]
B(1) EST=  [illegible]
```

SYSTEM=OV-1

YVARIABLE= TOTAL NUMBER OF SORTIES

XVARIABLE= TOTAL FLYING HOURS

VIETNAM NO. OF OBS. =28



ANOVA TABLE

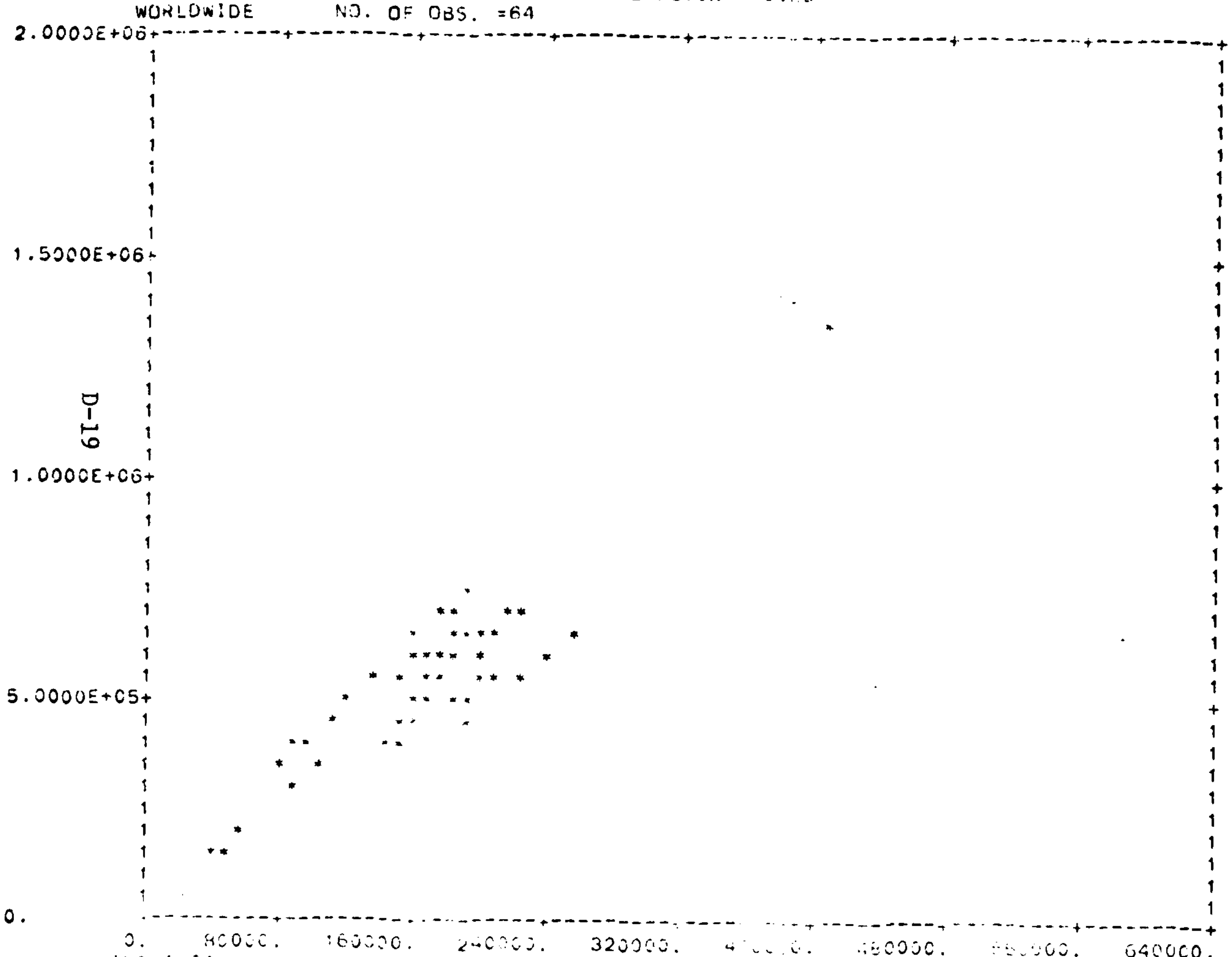
REGRESSION	DF=	1.	SS=	1.247096783214E+9	MS=	1.247096783214E+9
RESIDUAL	DF=	27.	SS=	11786092.78561	MS=	436521.9550225
TOTAL	DF=	26.	SS=	1.258882876E+9		

F-TEST= 2856.893608364

R**2= 99.06376573943 S= 660.6980815944 CORR EST= .9817881508631

B(1) EST= .5763007378894

SYSTEM=UH-1
YVARIABLE= TOTAL NUMBER OF SORTIES
XVARIABLE= TOTAL FLYING [illegible]
WORLDWIDE NO. OF OBS. =64

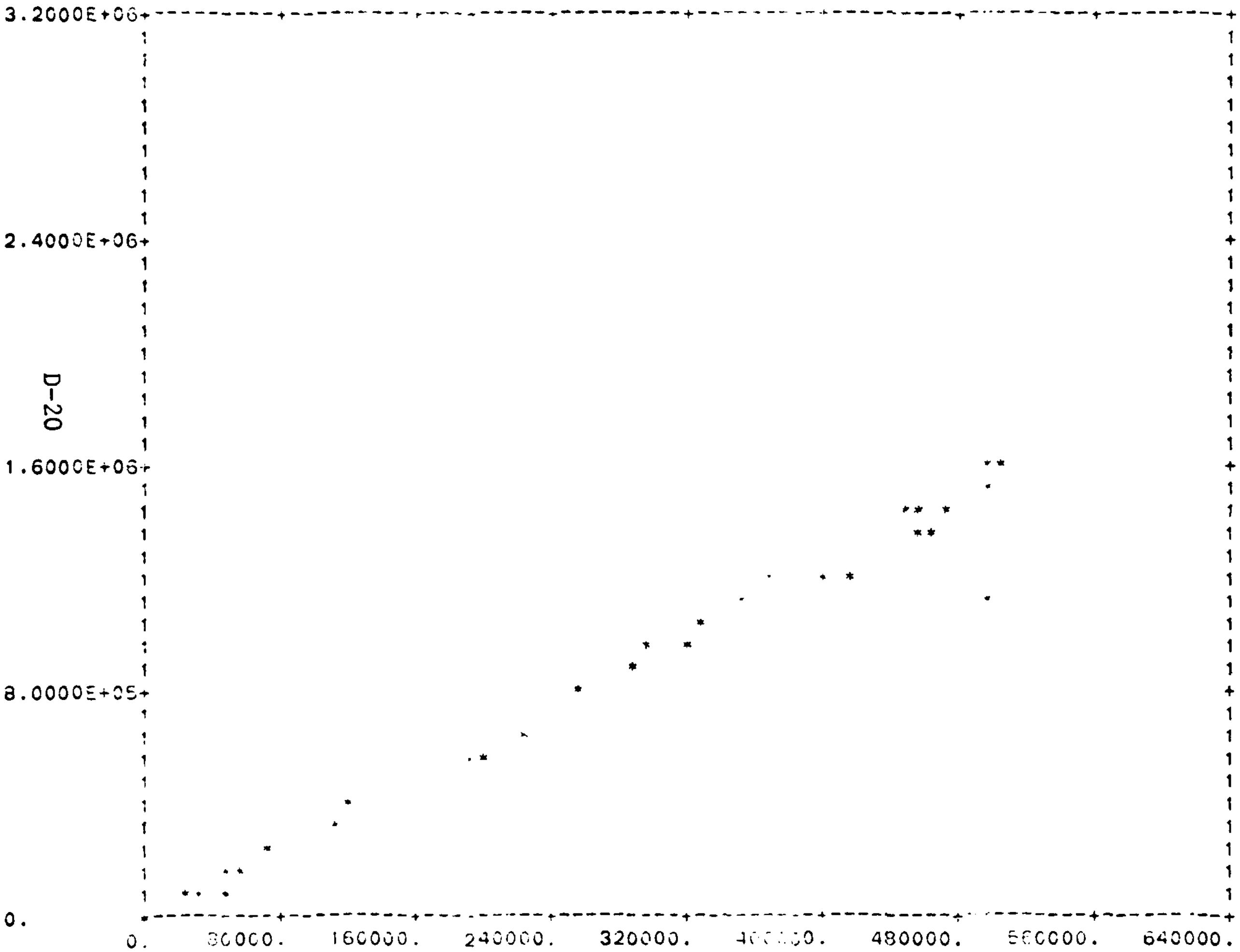


ANOVA TABLE

REGRESSION	DF=	1.	SS=	[illegible]9274703E+13	[illegible]	1.[illegible]18689274[illegible]E+13
RESIDUAL	DF=	63.	SS=	[illegible]37004501E+[illegible]	[illegible]	[illegible].69958349[illegible]
TOTAL	DF=	64.	SS=	[illegible]507485E+13		

F-TEST= 2504.[illegible]
R**2= [illegible] [illegible] [illegible]75.5900422[illegible] [illegible] [illegible]8794849[illegible]
B(1) EST= [illegible]

SYSTEM=[illegible]
YVARIABLE= TOTAL NUMB[illegible] SORTIES
XVARIABLE= TOTAL FLYING [illegible]
VIETNAM NO. OF OBS. [illegible]



ANOVA TABLE

REGRESSION	DF=	1.	SS=	2.9637471299275E+13	[illegible]	2.96374712[illegible]27E+13
RESIDUAL	DF=	28.	SS=	2.189292390125E+11	MS=	7.818901393304E+9
TOTAL	DF=	29.	SS=	2.985640053828E+13		

F-TEST= 3790.4904[illegible]0409
R**2= 99.2[illegible]72594464 S= 88424.55198249 CORR EST= .9851907323035
B(1) EST= 3.013280620918

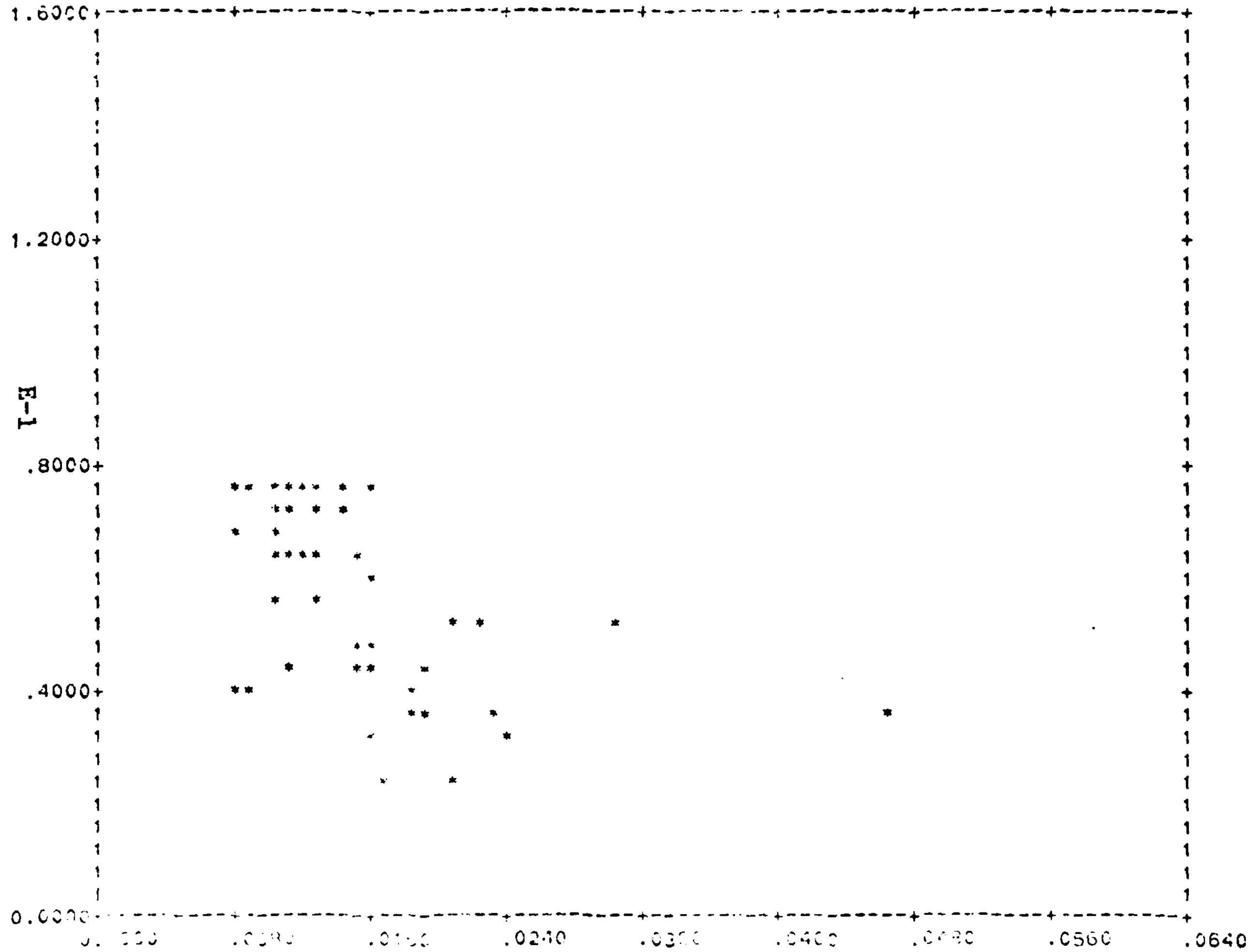
APPENDIX E

1352 FAILURE DATA

REGRESSION ANALYSIS

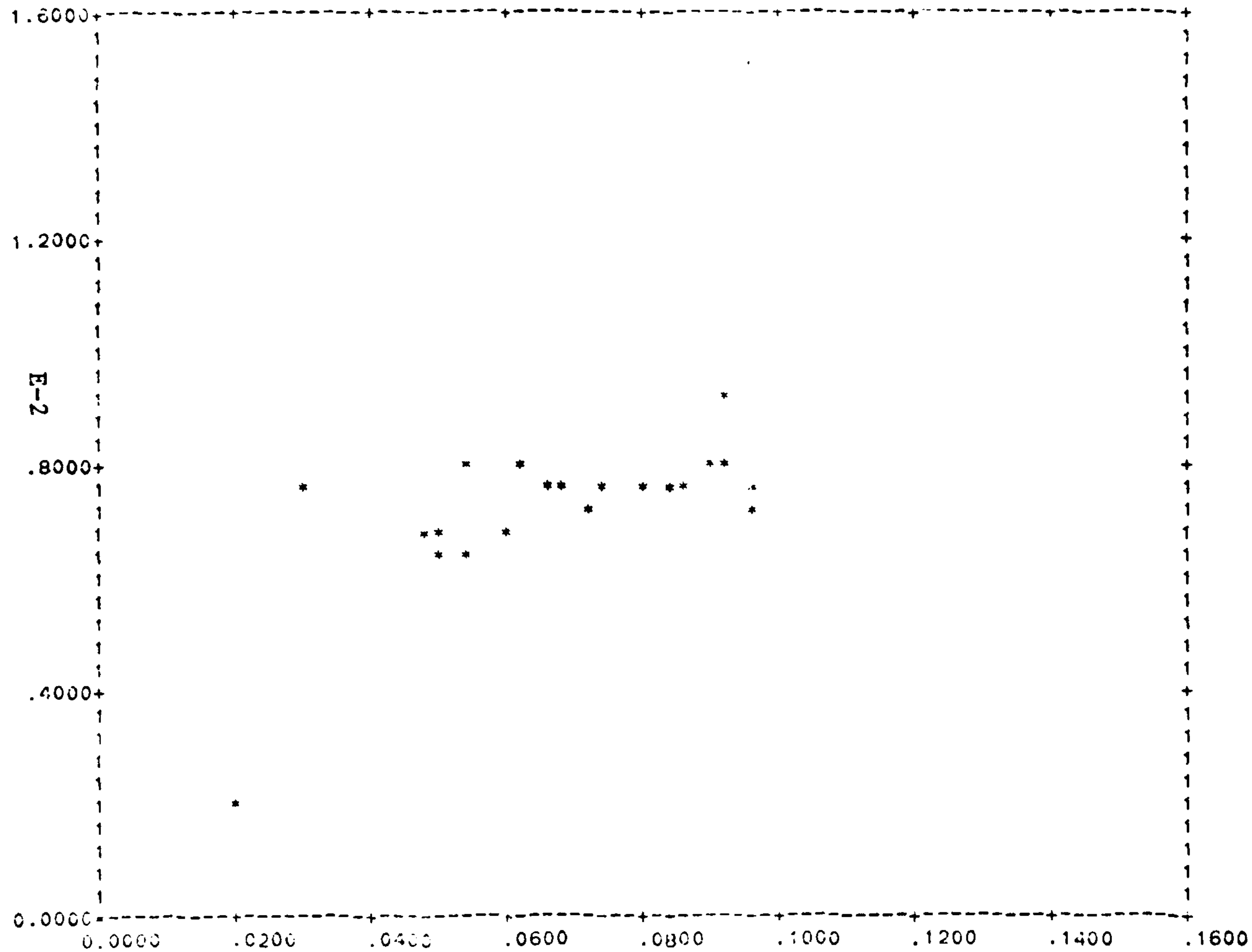
Y VARIABLE (DEPENDENT)	X VARIABLE (INDEPENDENT)
RELIABILITY	USAGE
AVAILABILITY	USAGE
RELIABILITY	LENGTH OF SORTIES (BY AIRCRAFT)
AVAILABILITY	LENGTH OF SORTIES (BY AIRCRAFT)
RELIABILITY	TOTAL FLYING HOURS
AVAILABILITY	TOTAL FLYING HOURS
AVAILABILITY	RELIABILITY

```
SYSTEM=AH-1
      YVARIABLE=                    AVERAGE RELIABILITY
      XVARIABLE=                    AVERAGE USAGE
    WORLDWIDE       NO. OF OBS. =55
```




```
   ANOVA [illegible] E
REGRESSION     DF=   1.    SS=   .4165053155475    MS=   .4165053155475
RESIDUAL       DF=  [illegible]   SS=   [illegible]87935404   MS=   .0181[illegible]827912346
TOTAL          DF=  [illegible]   SS=   1.[illegible]74109091
F-TEST=   23.[illegible]
R**2=   [illegible]    CORRELATION EST=    -.[illegible]239958
S=   .13[illegible]
SLOPE EST=   -14.[illegible]     INTERCEPT EST=   [illegible]8015519
```

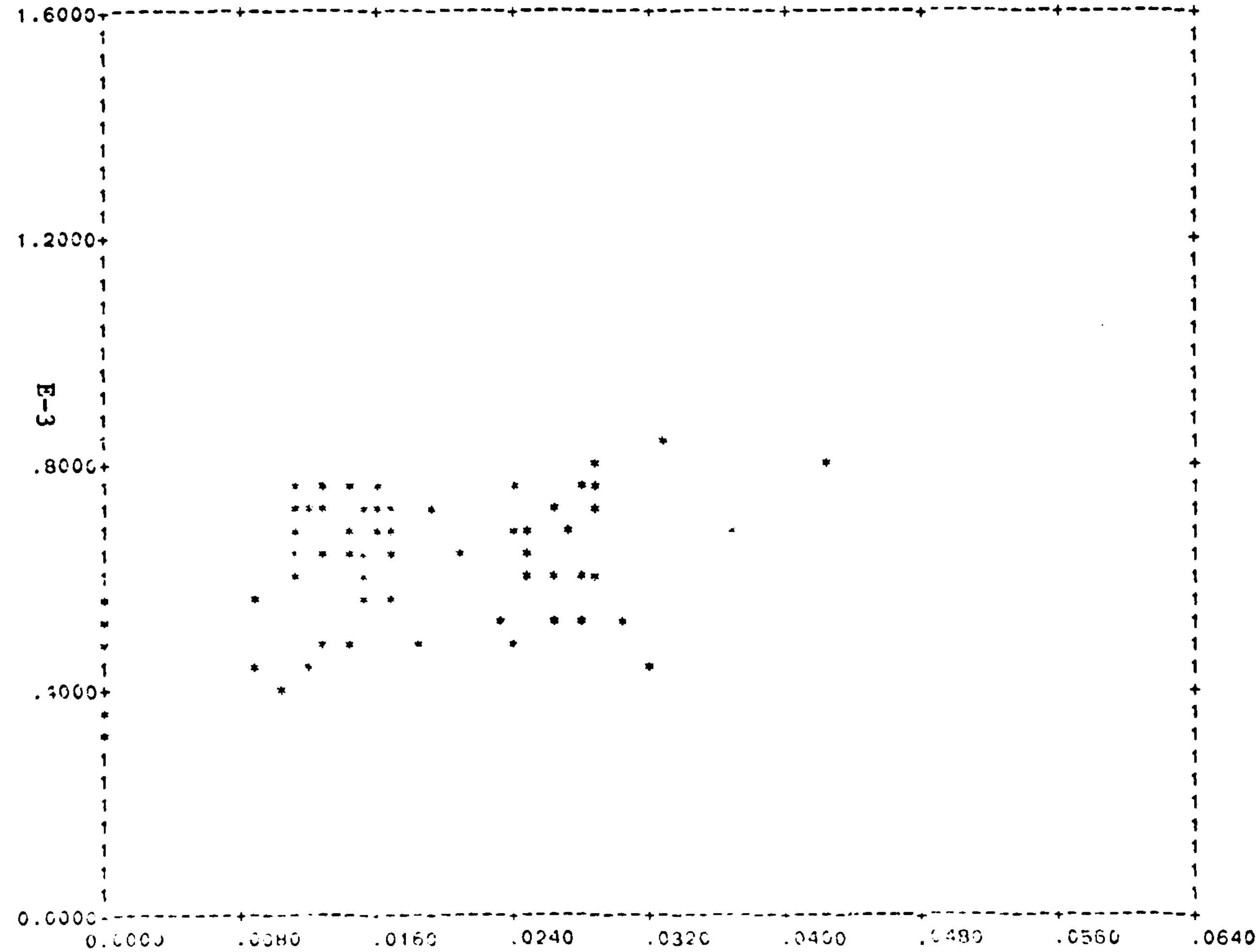
SYSTEM=AH-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =23



ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  .1505375538597   MS=  .1505375538597
RESIDUAL     DF= 21.   SS=  .2215376635316   MS=  .01054941254913
TOTAL        DF= 22.   SS=  .3720752173913
F-TEST=  14.26975702757
R**2=  40.45890369026      CORRELATION EST=  .6360731[illegible]37
S=  .1027103332149
SLOPE EST=  5.98459607157     INTERCEPT EST=  .4552[illegible]669305
```

SYSTEM=CH47
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =65



ANOVA TABLE

REGRESSION	DF= 1.	SS= .01325686296601	MS= .01325686296601
RESIDUAL	DF= 63.	SS= .7[illegible]85216494	MS= .01210140510555
TOTAL	DF= 64.	SS= .7[illegible]53346154	

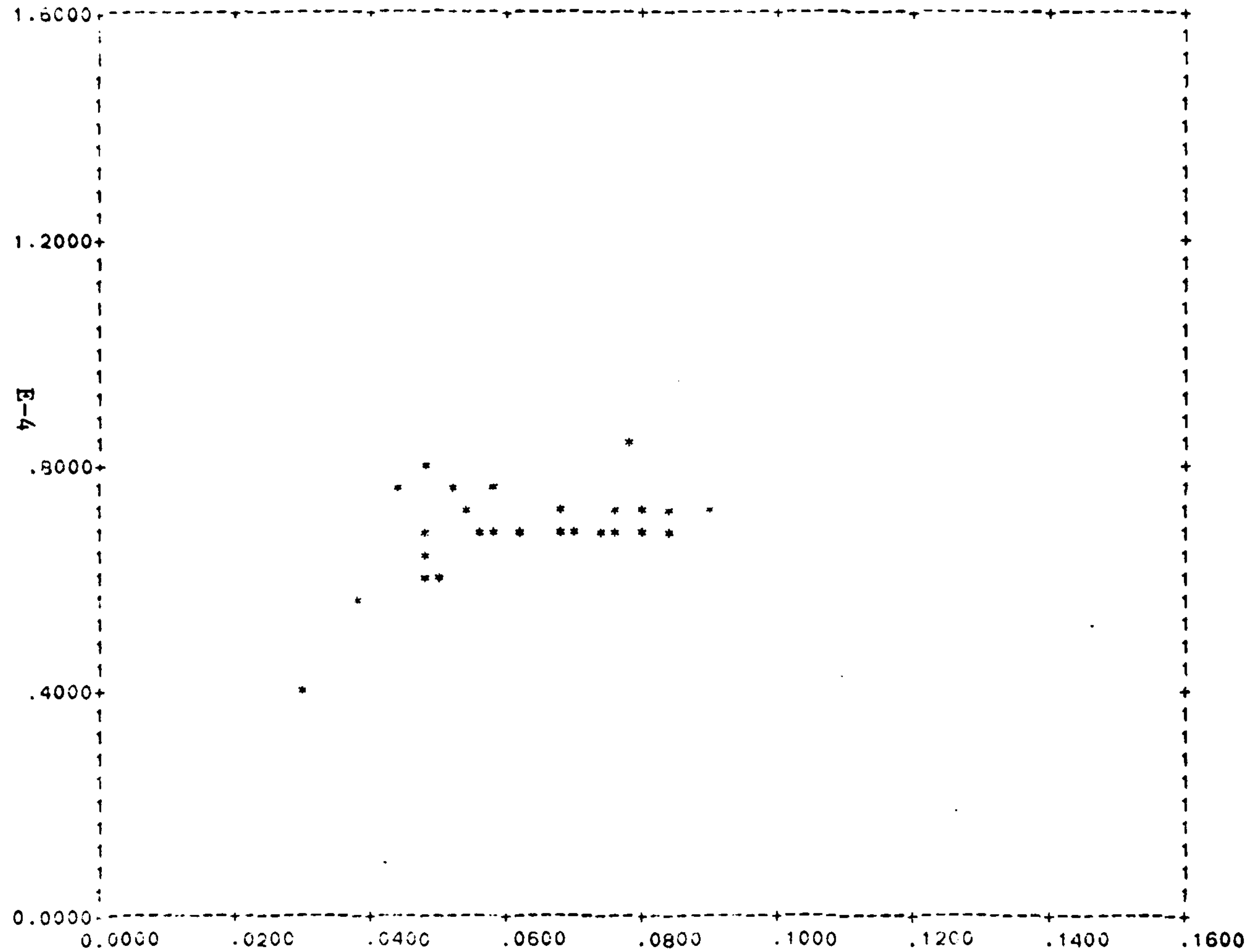
F-TEST= 1.0954812[illegible]7461
R**2= [illegible] CORRELATION EST= .1[illegible]231
S= .1[illegible]
SLOPE EST= 1.[illegible] INTERCEPT EST= .60[illegible]0750436

SYSTEM-C147

Y VARIABLE= AVERAGE RELIABILITY

X VARIABLE= AVERAGE USAGE

[illegible] NO. OF OBS. =28



ANOVA TABLE

REGRESSION	DF=	1.	SS=	.0367193689896З	MS=	.0367193689896[illegible]
RESIDUAL	DF=	26.	SS=	.1460014881532	MS=	.005615441852045
TOTAL	DF=	27.	SS=	.1827208571429		

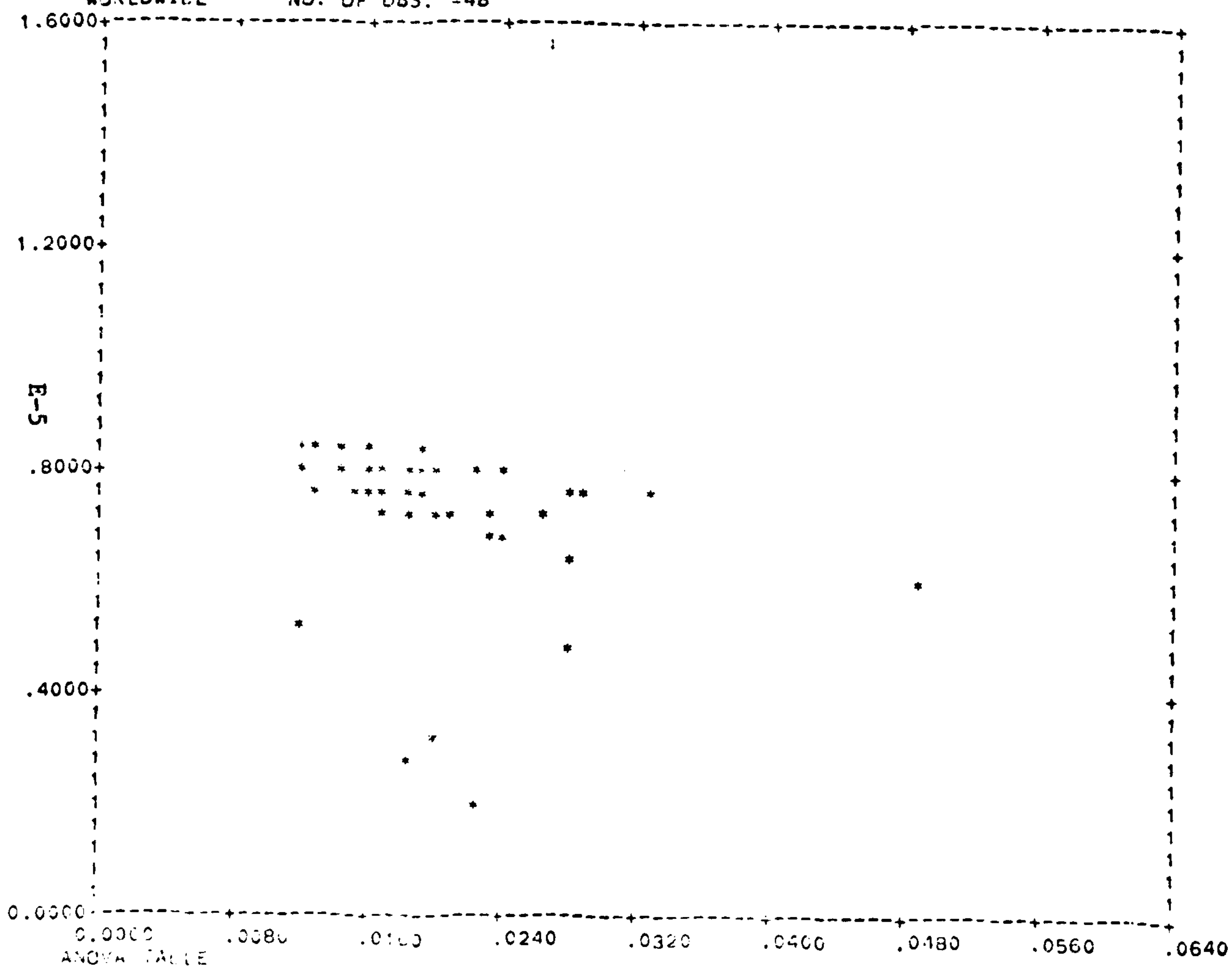
F-TEST= 6.53[illegible]9059586

R**2= 20.09588262875 CORRELATION EST= .448[illegible]41217

S= .07493625192152

SLOPE EST= 2.341028661589 INTERCEPT EST= .540[illegible]23209117

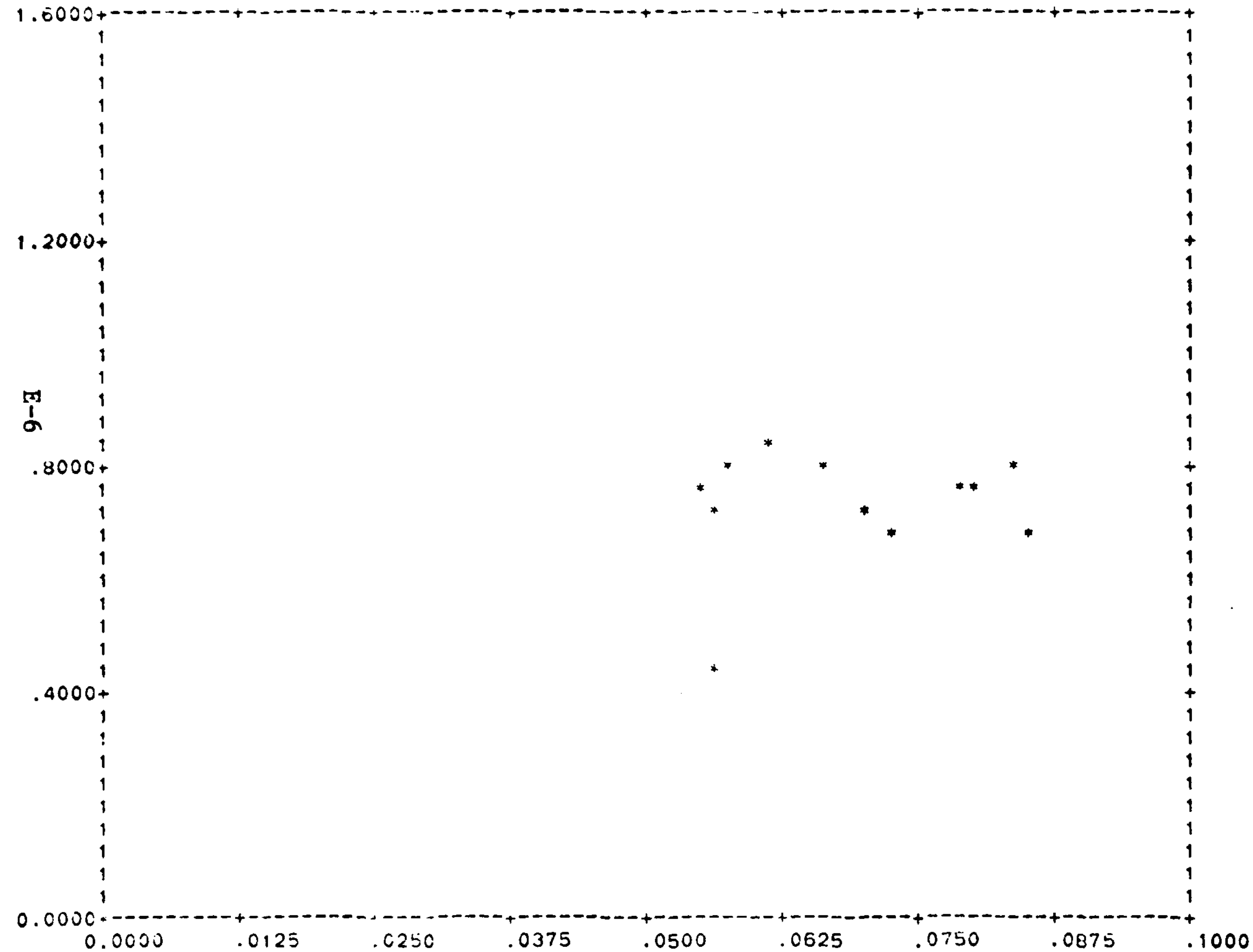
```
SYSTEM=OH58
      YVARIABLE=                    AVERAGE RELIABILITY
      XVARIABLE=                    AVERAGE USAGE
    WORLDWIDE        NO. OF OBS. =48
```



E-5

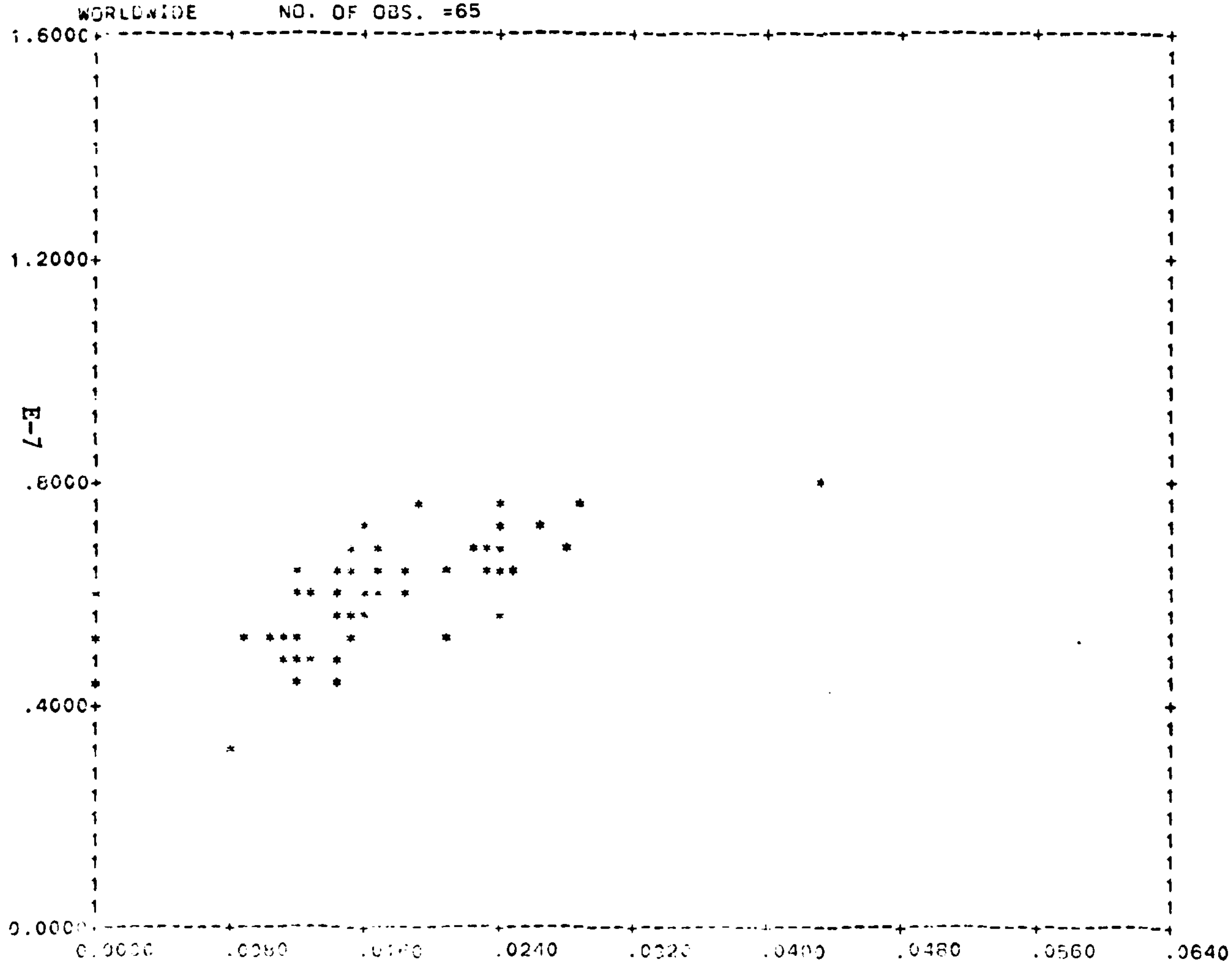
```
ANOVA TABLE
REGRESSION    DF=   1.    SS=   .0[illegible]38622620   MS=   .03[illegible]38622629
RESIDUAL      DF=   4[illegible].   SS=   .9[illegible]98637737   MS=   .01[illegible]019269073
TOTAL         DF=   4[illegible].   SS=   .9[illegible]8725
F-TEST=   2.014104420[illegible]48
R**2=   4.[illegible]8261757      CORRELATION EST=   -.2[illegible]548339
S=   .1403[illegible]9537331
SLOPE EST=   -4.47129[illegible]5642      INTERCEPT EST=   .[illegible]82776565
```

SYSTEM=OH58
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =14




```
ANOVA TABLE
REGRESSION    DF=   1.   SS=   .001144403413217   MS=   .001144403413217
RESIDUAL      DF=  12.   SS=   .1298410965868     MS=   .01082009138223
TOTAL         DF=  13.   SS=   .1309855
F-TEST=   .1057665201512
R**2=   .8736870975926       CORRELATION EST=    .09347123073933
S=   .1040196682471
SLOPE EST=   .8527596223675      INTERCEPT EST=    .6736341684822
```

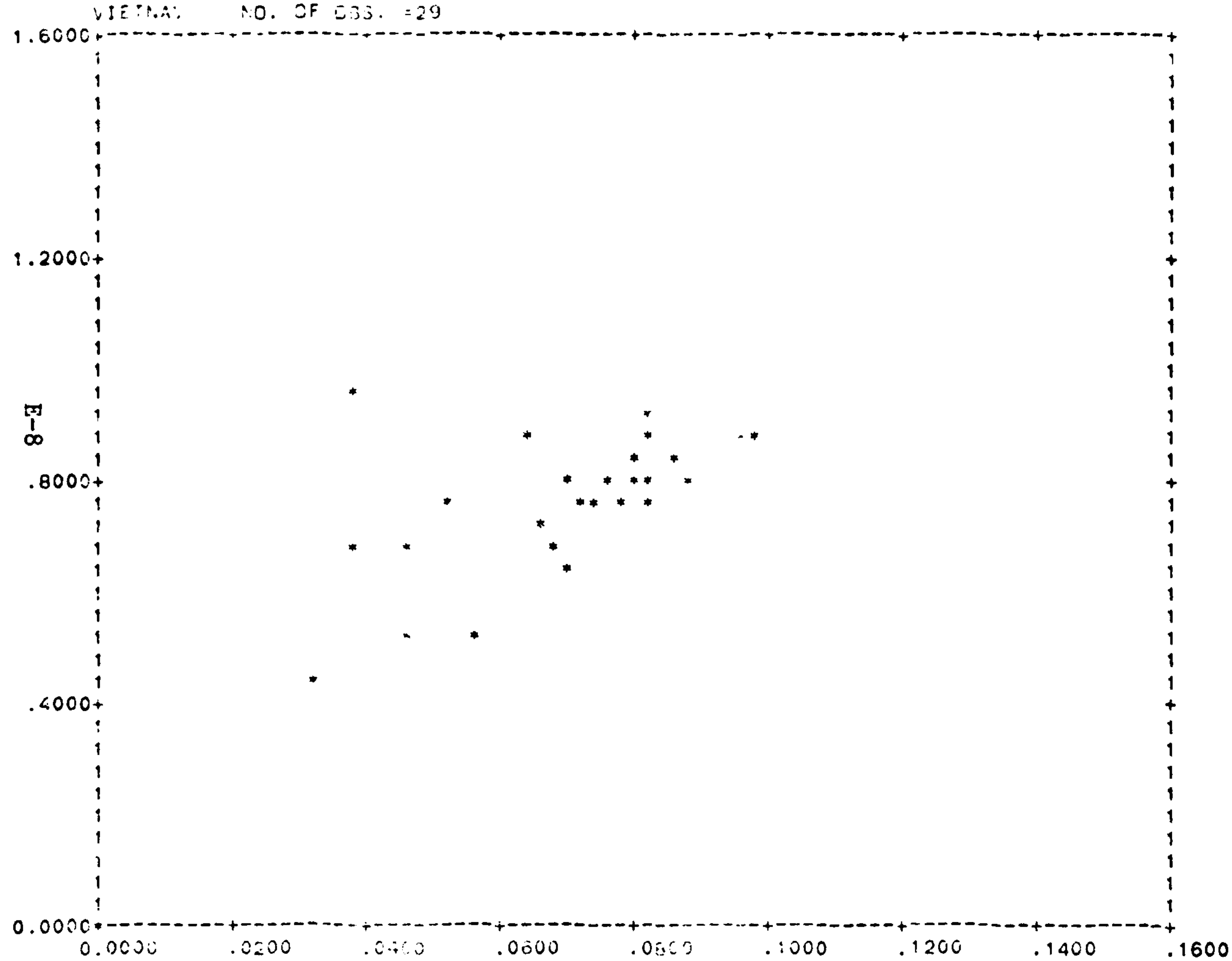
SYSTEM=OV-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =65



E-7

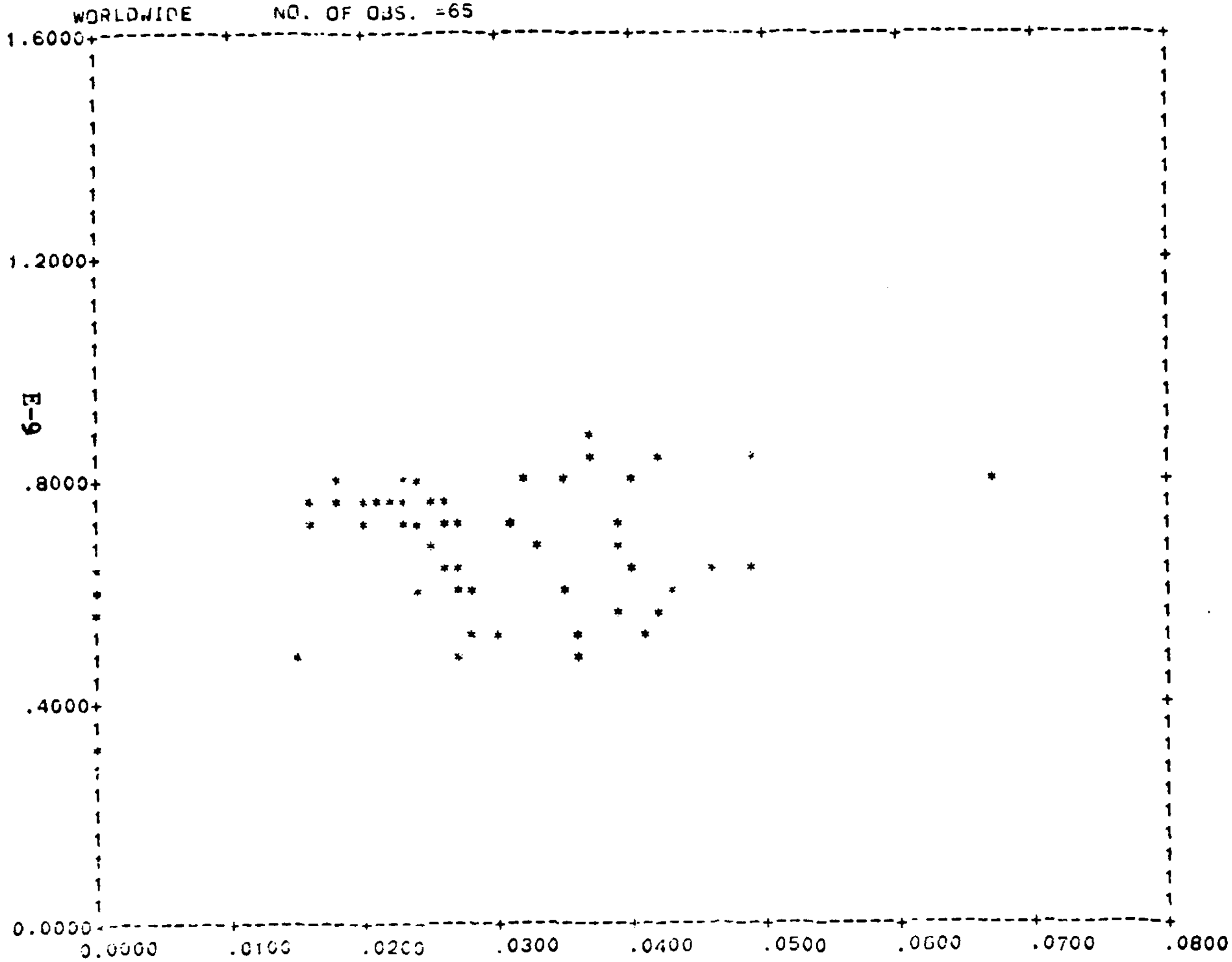
ANOVA TABLE
REGRESSION DF= 1. SS= .2900378275901 MS= .2900378275901
RESIDUAL DF= 63. SS= .2644186339484 MS= .0041971211173784
TOTAL DF= 64. SS= .5544564615385
F-TEST= 69.10309199847
R**2= 52.31[illegible] CORRELATION EST= .7232[illegible]548115
S= .0647[illegible]
SLOPE EST= 11.1042[illegible]83 INTERCEPT EST= [illegible]44472

SYSTEM OV-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =29




```
ANOVA TABLE
REGRESSION    DF=  1.   SS=  .1416639089608   MS=  .1416639089608
RESIDUAL      DF=  27.  SS=  .2818653324185   MS=  .0104394567562 4
TOTAL         DF=  28.  SS=  .4235292413793
F-TEST=  13.5700485399
R**2=  33.4484304053 5    CORRELATION EST=  .5783462 31987
S=  .102173659796 3
SLOPE EST=  4.1084259137 52    INTERCEPT EST=  .4784513131081
```

SYSTEM=UH-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =65

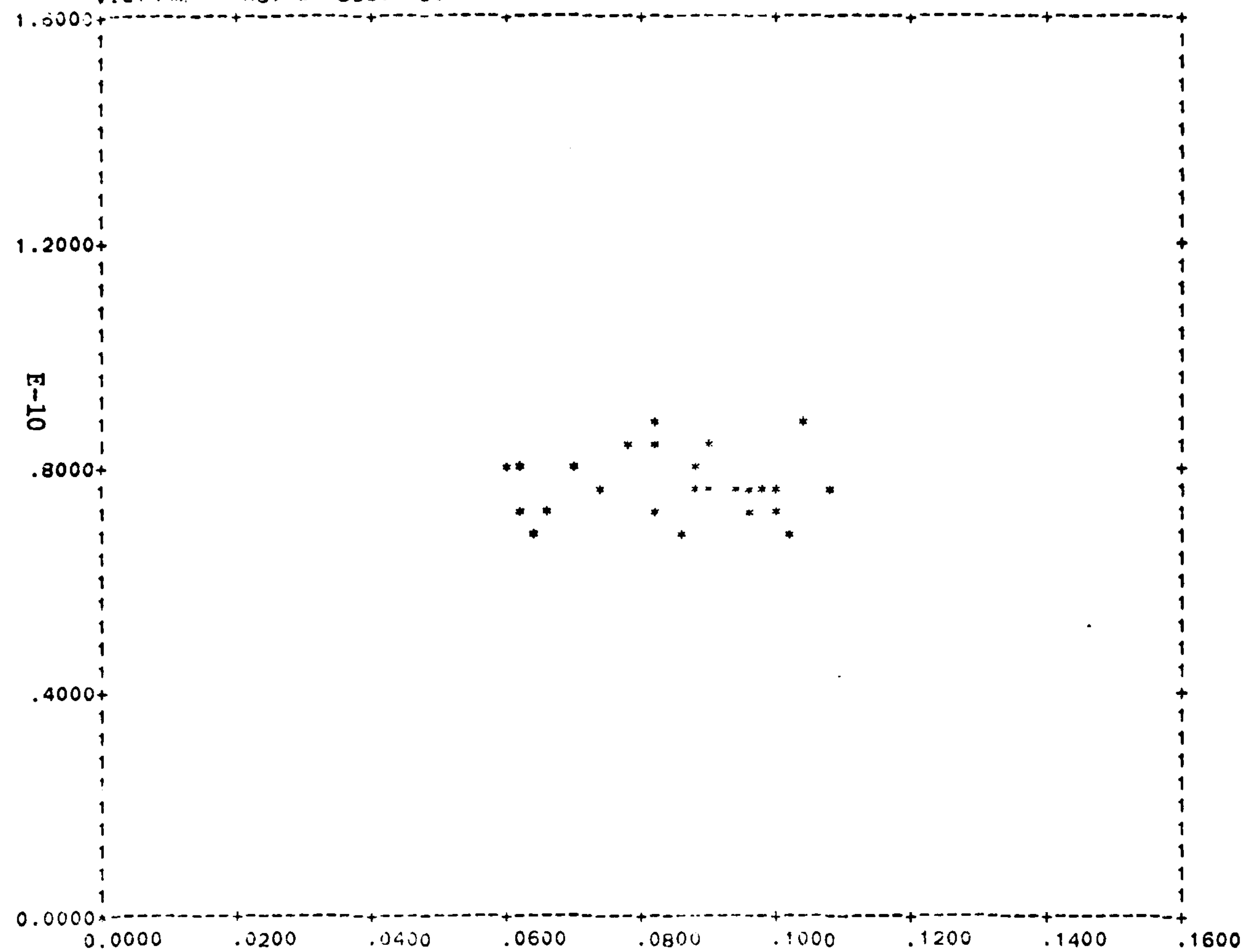


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.01116961907045	MS=	.01116961907045
RESIDUAL	DF=	63.	SS=	.6459613963142	MS=	.01025335549705
TOTAL	DF=	64.	SS=	.6571310153846		

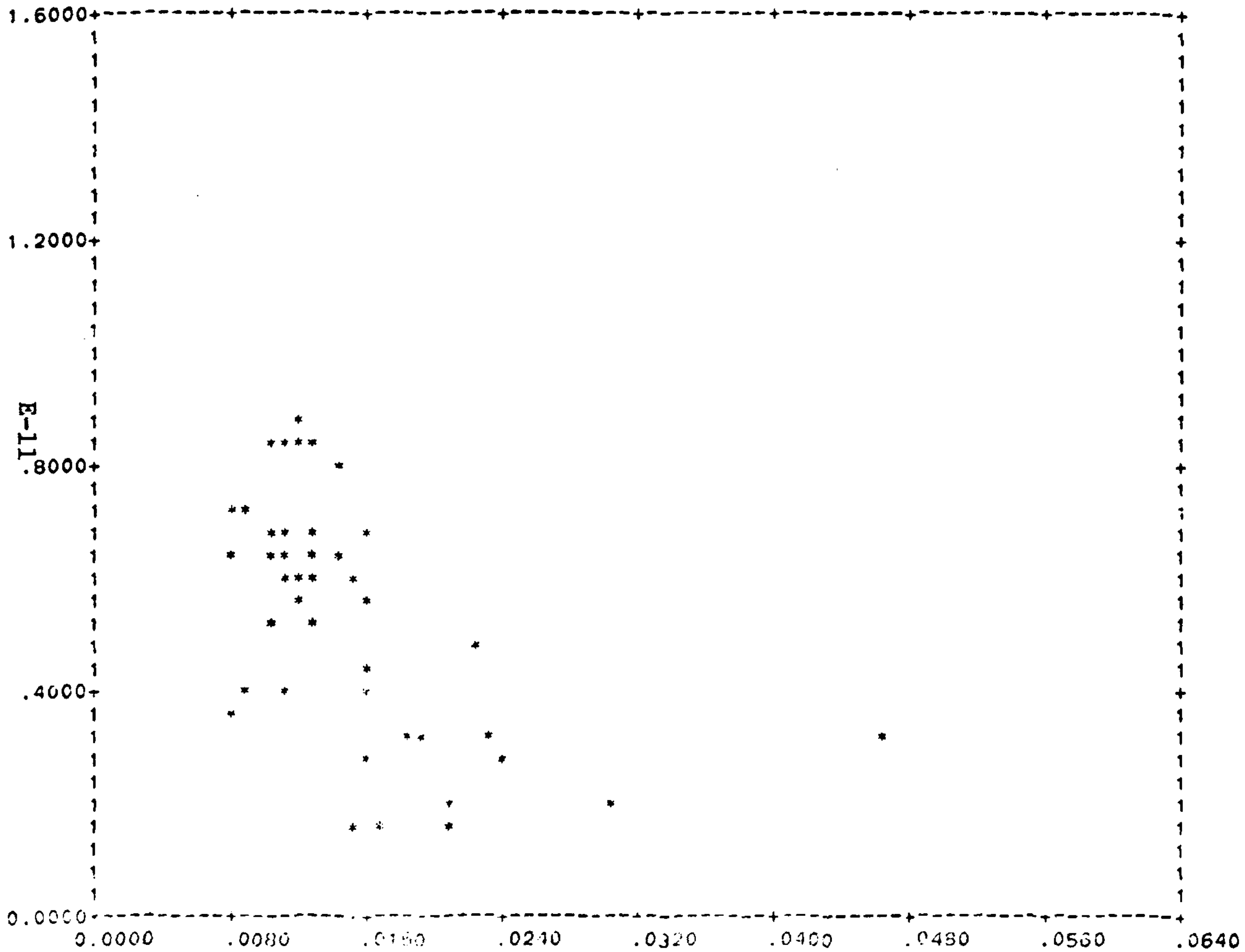
F-TEST= 1.08956221[illegible]92
R**2= [illegible] CORRELATION EST= -.130[illegible]321
S= .1012[illegible]539[illegible]3
SLOPE EST= -1.[illegible]06200657[illegible] INTERCEPT EST= .740[illegible]55883

```
SYSTEM=UH-1
   YVARIABLE=                          AVERAGE RELIABILITY
   XVARIABLE=                          AVERAGE USAGE
  VIETNAM    NO. OF OBS. =30
```



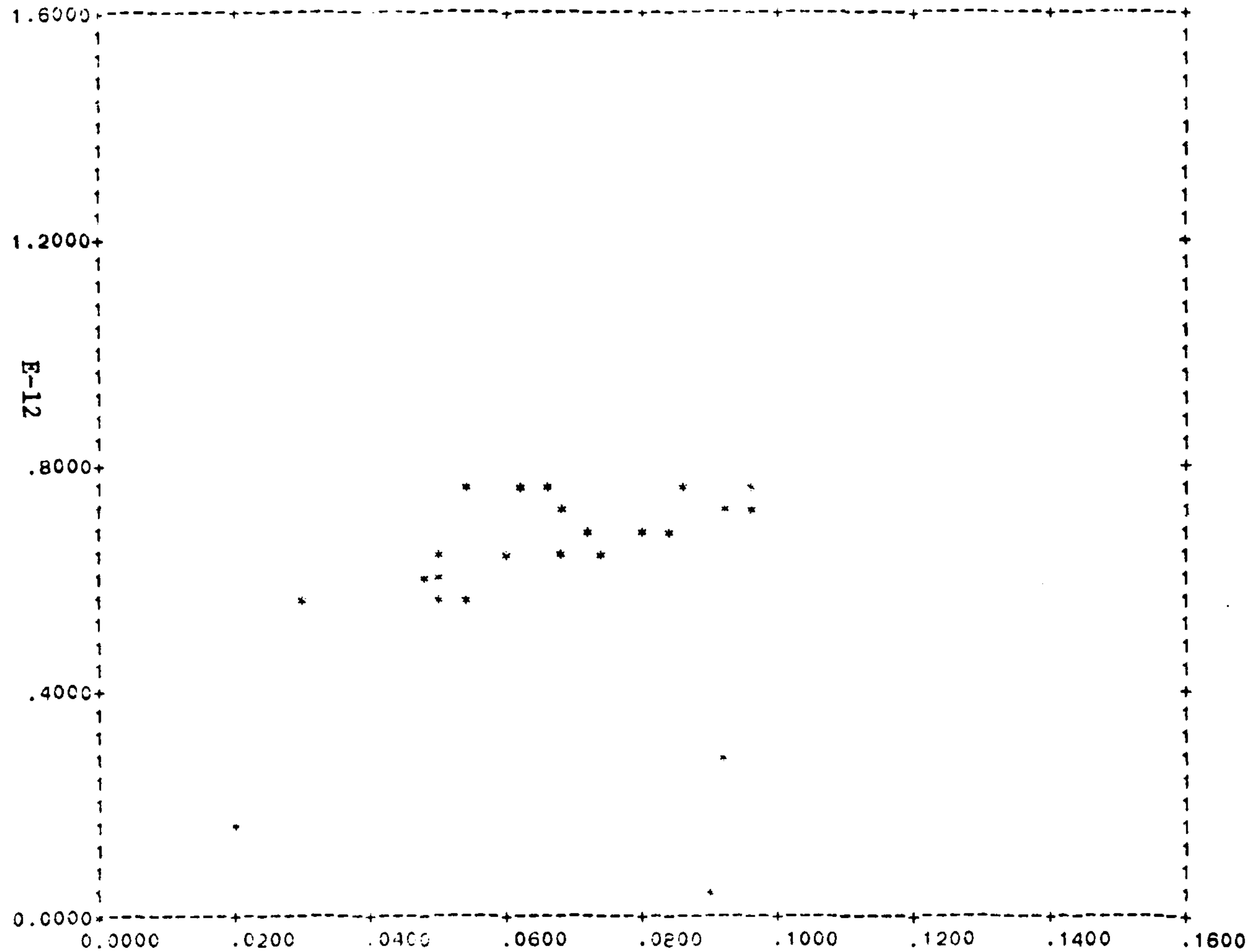

```
   ANOVA TABLE
REGRESSION    DF=   1.   SS=   .00007445657542885   MS=   .00007445657542885
RESIDUAL      DF=  28.   SS=   .07552291009124   MS=   .002697246788973
TOTAL         DF=  29.   SS=   .07559736666667
F-TEST=   .02760465810204
R**2=   .09849096431778      CORRELATION EST=    -.03139327011600
S=   .0519350246844
SLOPE EST=   -.115639742331      INTERCEPT EST=   .770503975191
```

```
SYSTEM=AH-1
     YVARIABLE=                        AVERAGE AVAILABILITY
     XVARIABLE=                        AVERAGE USAGE
   WORLDWIDE      NO. OF OBS. =54
```




```
    ANOVA TABLE
REGRESSION    DF=   1.   SS=   .7661190139064   MS=   .7661190139064
RESIDUAL      DF=  52.   SS=  1.[illegible]26319427  MS=   .0277[illegible]12152744
TOTAL         DF=  53.   SS=  2.[illegible]45333333
F-TEST=   27.5729[illegible]
R**2=   34.[illegible]        CORRELATION EST=   -.58[illegible]
S=   .16[illegible]
SLOPE EST=   -19.02188287[illegible]54      INTERCEPT EST=   [illegible]10414778
```

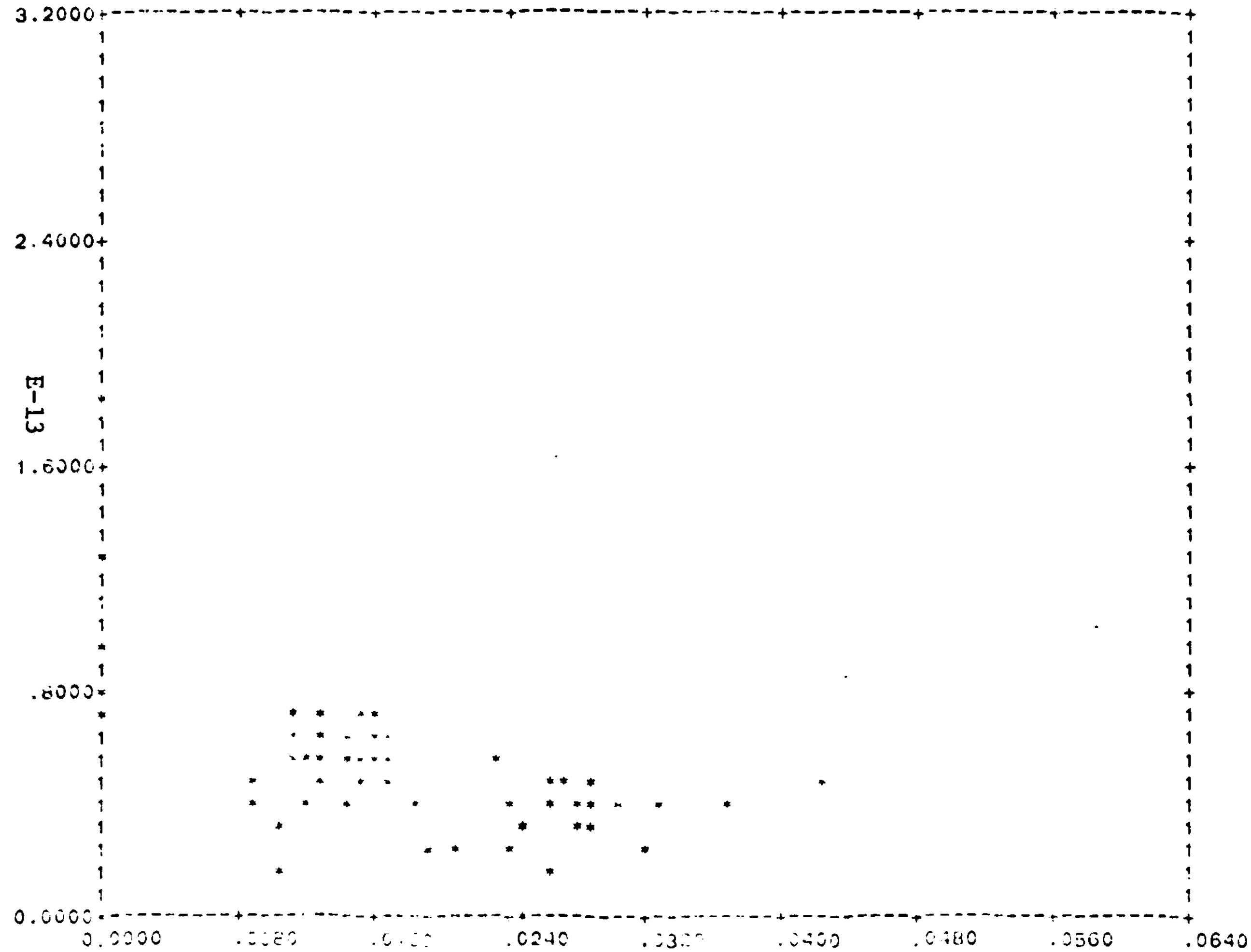
SYSTEM= UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =23



ANOVA TABLE

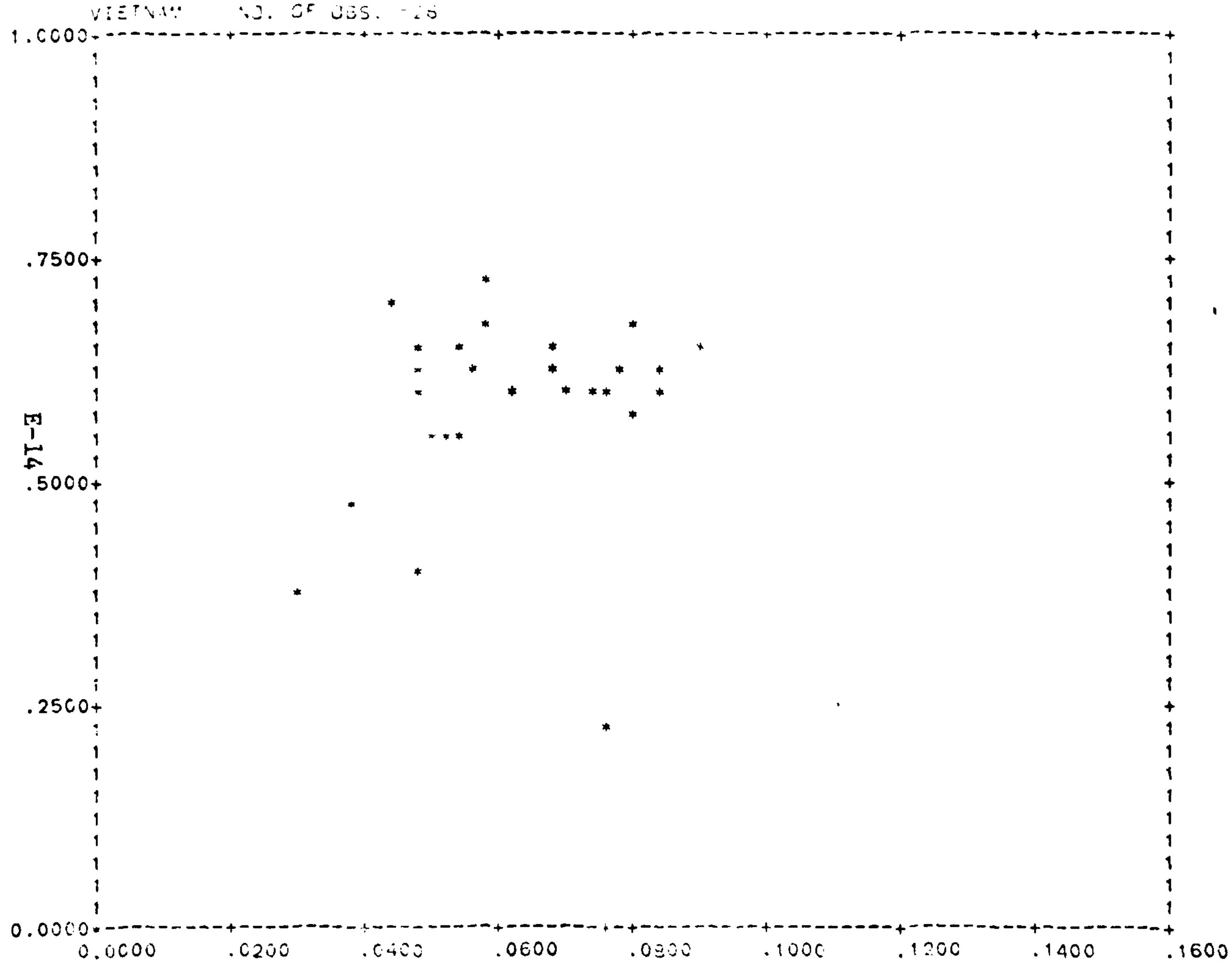
```
REGRESSION   DF=   1.   SS=  .02184320639643   MS=  .02184320639643
RESIDUAL     DF=  21.   SS=  .8010834022992    MS=  .03814682868092
TOTAL        DF=  22.   SS=  .8229266086957
F-TEST=   .5726087109139
R**2=   2.654332253402      CORRELATION EST=    .1629212157272
S=   .1953121314228
SLOPE EST=   1.517819639205      INTERCEPT EST=   .5020304483799
```

SYSTEM-CH47
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =64



ANOVA TABLE
REGRESSION DF= 1. SS= .2583?6414527 MS= .2?83?6414527
RESIDUAL DF= 62. SS= 1.08?485335473 MS= .0174916?895924
TOTAL DF= 63. SS= 1.3?2?6175
F-TEST= 15.04307?? ??
R**2= .1?37??21?? CORRELATION EST= -.44????01?74
S= .132???????
SLOPE EST= -8.?3??2??????? INTERCEPT EST= .????????31104

SYSTEM-C[illegible]
YVARIABLE= AVERAGE AVAIL[illegible]
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =28

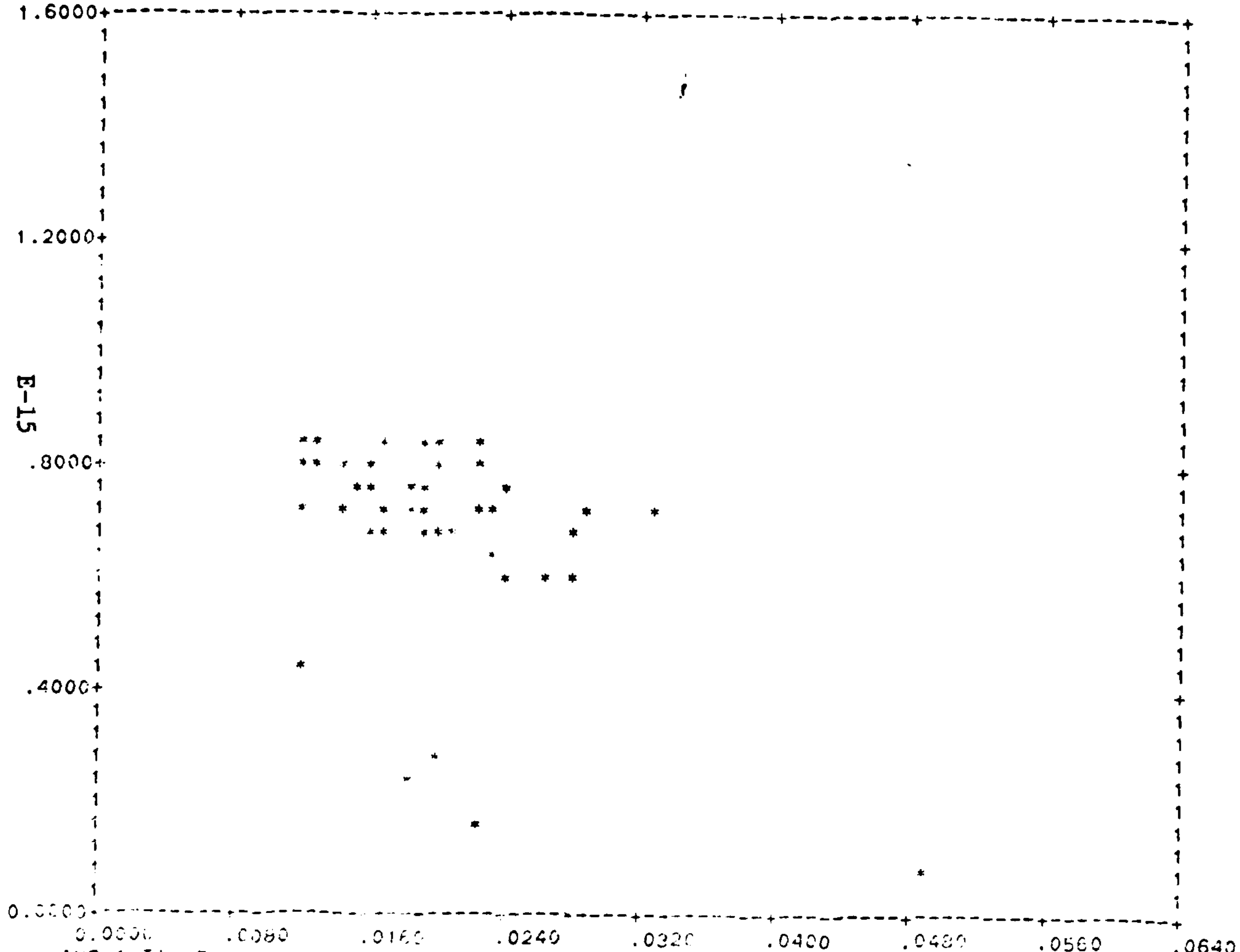


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.0005179970791284	MS=	.0005179970791284
RESIDUAL	DF=	26.	SS=	.6223946814923	MS=	.0239382569804[illegible]
TOTAL	DF=	27.	SS=	.6229126785714		

F-TEST= .021633[illegible]037257
R**2= .0[illegible]15725[illegible]13012 CORRELATION EST= .028[illegible]09951974
S= .1547199307797
SLOPE EST= .2780499245748 INTERCEPT EST= .54[illegible]5643866292

```
SYSTEM=CH58
      YVARIABLE=                    AVERAGE AVAILABILITY
      XVARIABLE=                    AVERAGE USAGE
    WORLDWIDE        NO. OF OBS. =47
```

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    ANOVA TABLE
REGRESSION      DF=   1.   SS=   .3085806978179   MS=   .3085806978179
RESIDUAL        DF=  45.   SS=  1.060994238352    MS=   .02357764974116
TOTAL           DF=  46.   SS=  1.36957493617
F-TEST=   13.0878480769
R**2=   22.531121[illegible]    CORRELATION EST=   -.47[illegible]
S=   .153[illegible]
SLOPE EST=   [illegible]    INTERCEPT EST=   .[illegible]7331197
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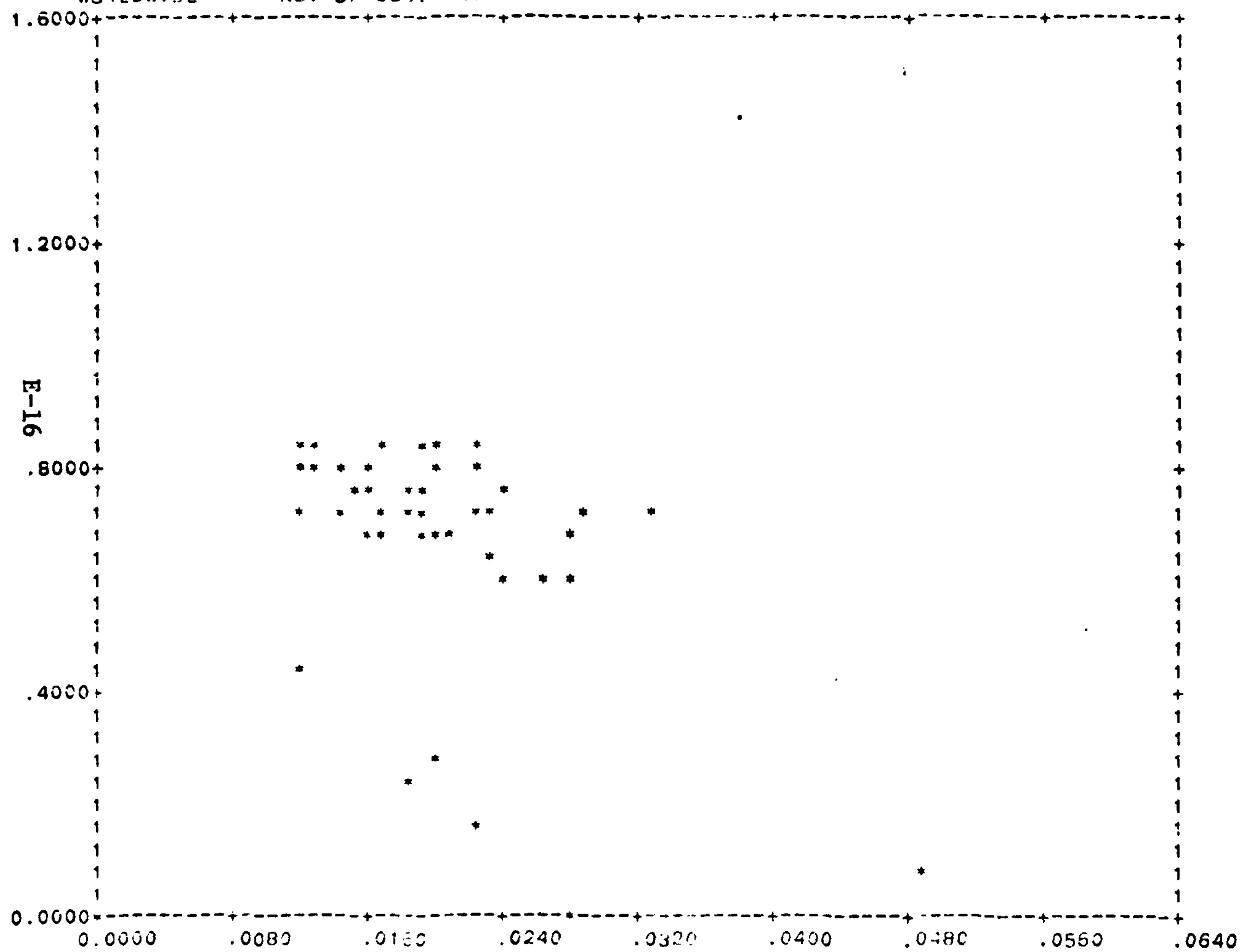
SYSTEM=OH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =47

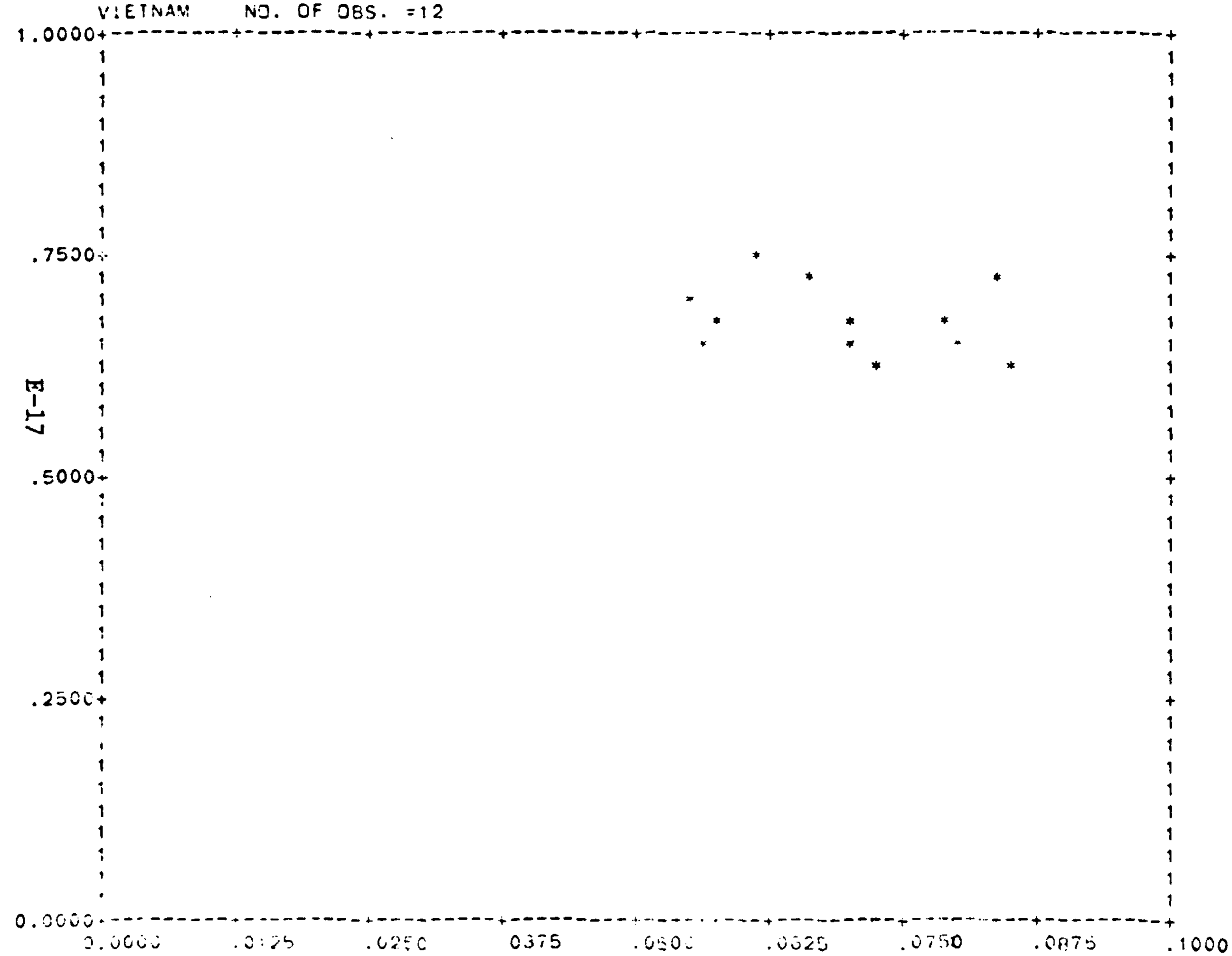


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.3085806978179	MS=	.3085806978179
RESIDUAL	DF=	45.	SS=	1.060994238352	MS=	.02357764974116
TOTAL	DF=	46.	SS=	1.36957493617		

F-TEST= 13.0873 [illegible] 07669
R**2= 22.5311 [illegible] 046 CORRELATION EST= -.474 [illegible] 057726
S= .152550.532298
SLOPE EST= -12.6810178512 INTERCEPT EST= .9381 [illegible] 8311 [illegible] 897

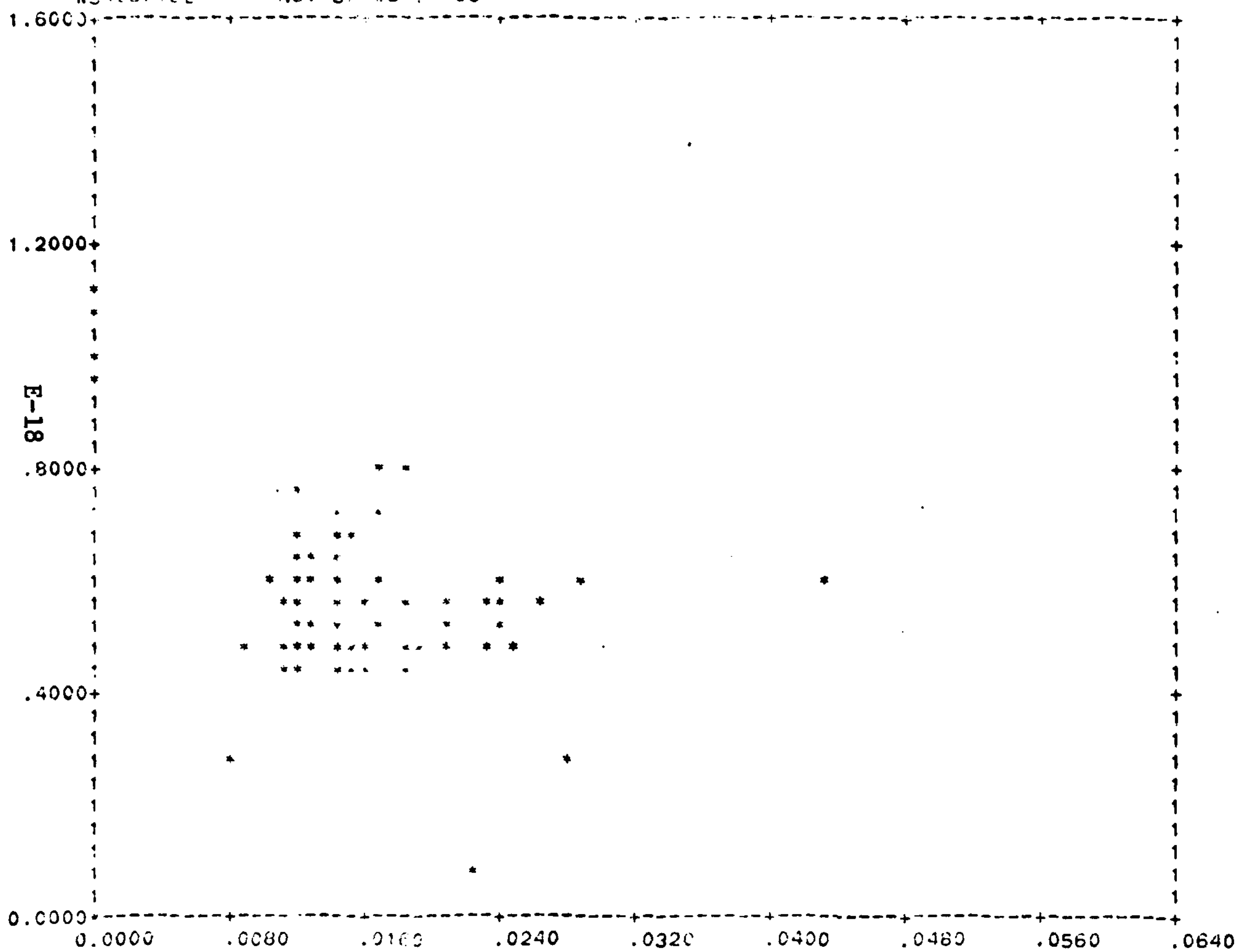
SYSTEM=CH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =12



ANOVA TABLE
REGRESSION DF= 1. SS= .00147741481627 MS= .00147741481627
RESIDUAL DF= 10. SS= .0116805851837[illegible] MS= .00116805851837[illegible]
TOTAL DF= 11. SS= .013158
F-TEST= [illegible]242253
R**2= [illegible]
S= .0340[illegible]
SLOPE EST= -1.[illegible]

CORRELATION EST= -.[illegible]
INTERCEPT EST= .7[illegible]847

SYSTEM OVH[illegible]
Y VARIABLE= AVERAGE AVAILABILITY
X VARIABLE= AVERAGE USAGE
WORKCODE NO. OF [illegible] 65



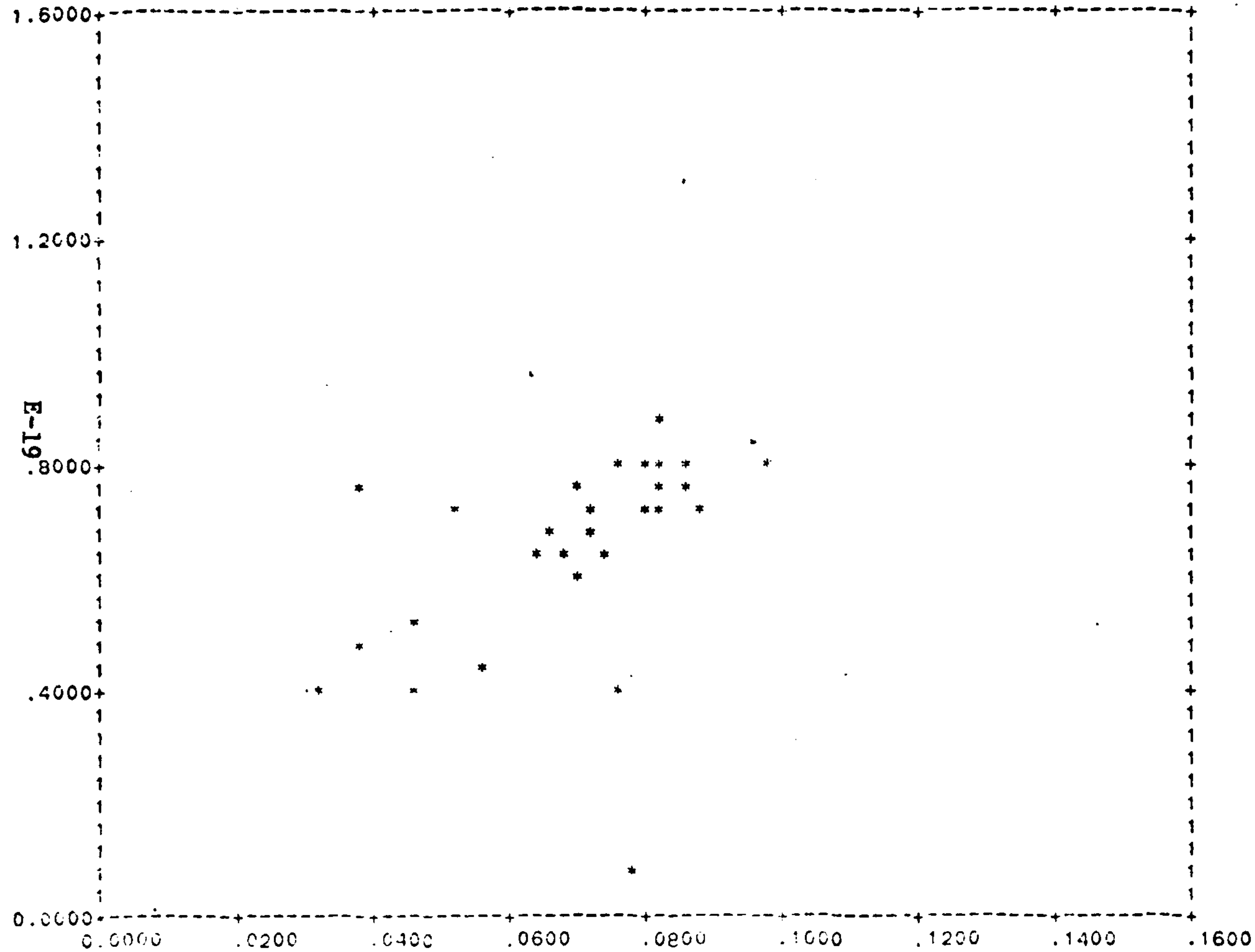
E-18

ANOVA TABLE

REGRESSION	DF=	1.	SS=	.004873414639446	MS=	.004873414639446
RESIDUAL	DF=	63.	SS=	.8683279099759	MS=	.01378298365041
TOTAL	DF=	64.	SS=	.8732013846154		

F-TEST= .35[illegible]5819792764
R**2= .5581068899[illegible]647 CORRELATION EST= -.07470[illegible]68642462
S= .1174009525107
SLOPE EST= -1.451052204778 INTERCEPT EST= .5629037661354

```
SYSTEM=OV-1
      YVARIABLE=                    AVERAGE AVAILABILITY
      XVARIABLE=                    AVERAGE USAGE
     VIETNAM    NO. OF OBS. =29
```



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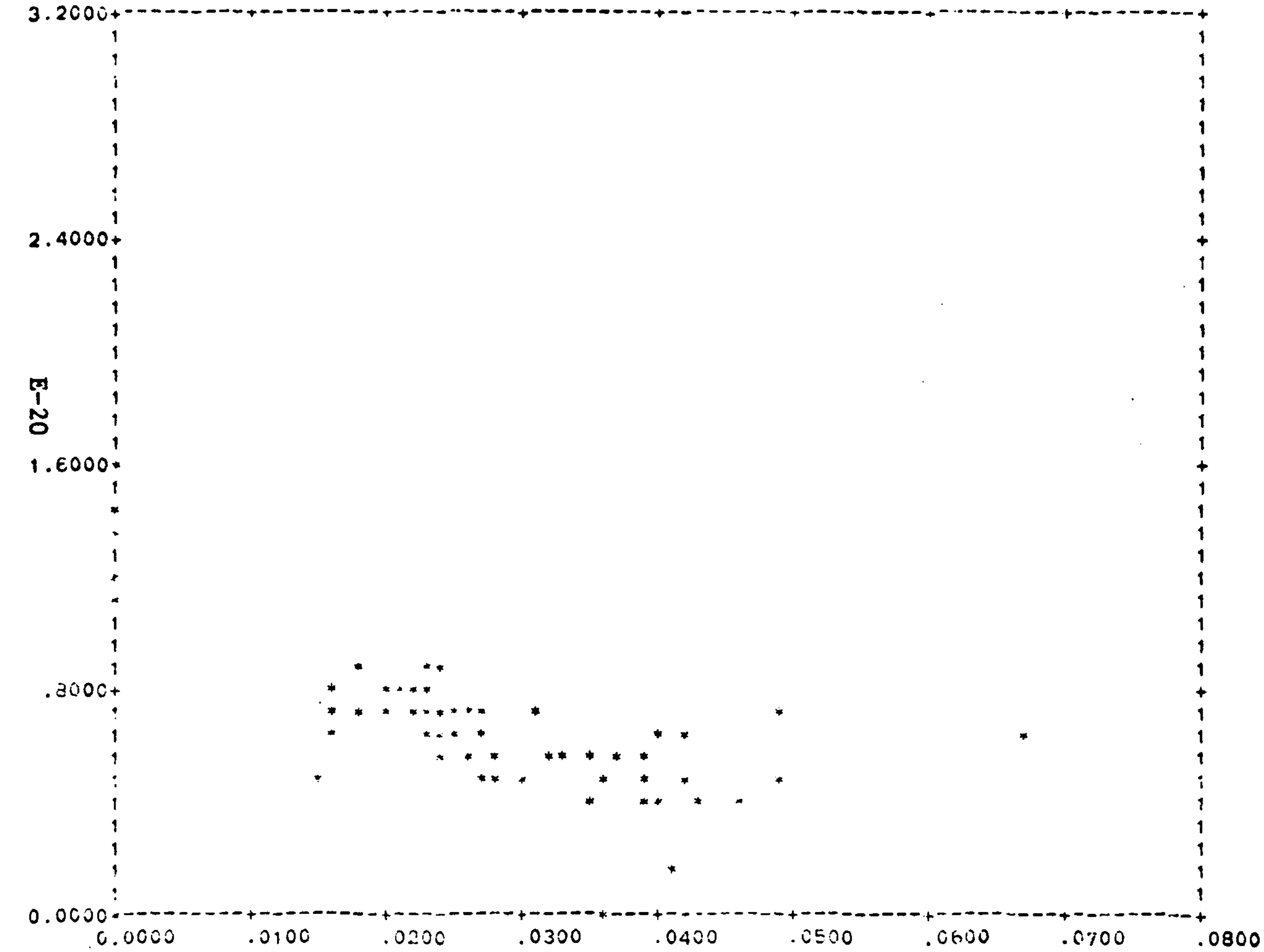
   ANOVA TABLE
RECRESSION     DF=   1.   SS=   .180258362354G   MS=   .180258362354G
RESIDUAL       DF=   27.  SS=   .6558160062631   MS=   .0242891257876З
TOTAL          DF=   28.  SS=   .8360847586207
F-TEST=   7.42136080504б7
R**2=   21.5608343[illegible]65      CORRELATION EST=    .48[illegible]74314
S=   .155849[illegible]97258
SLOPE EST=   4.634400473311      INTERCEPT EST=   .33[illegible]463581
```

SYSTEM=UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =65

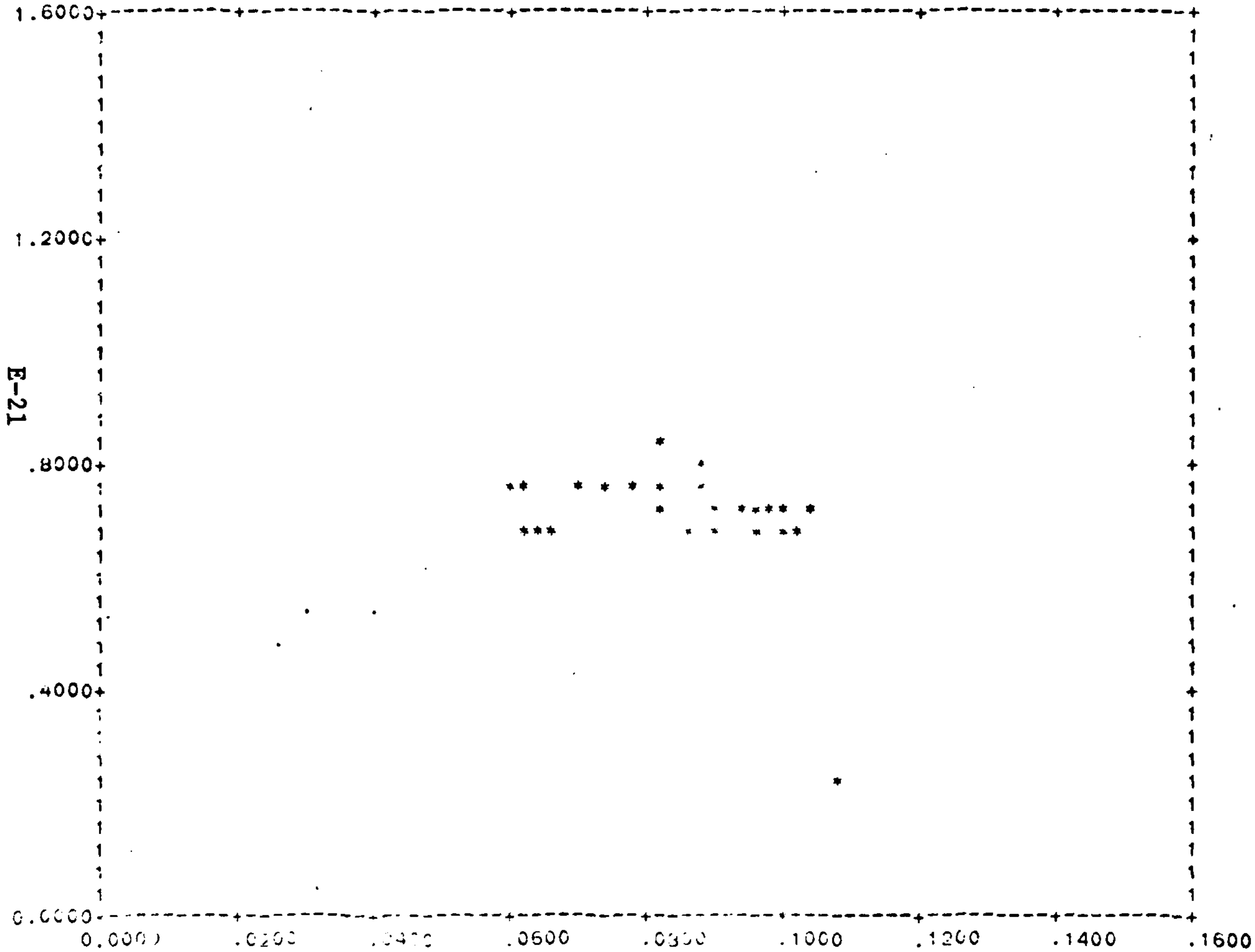


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.534647438468	MS=	.534647438468
RESIDUAL	DF=	63.	SS=	1.214145546147	MS=	.01927215152615
TOTAL	DF=	64.	SS=	1.748792984615		

F-TEST= 27.74106942893
R**2= 30.57236356636 CORRELATION EST= -.5529226577872
S= .1388241748621
SLOPE EST= -9.205354796418 INTERCEPT EST= .880395784966

SYSTEM=UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =30

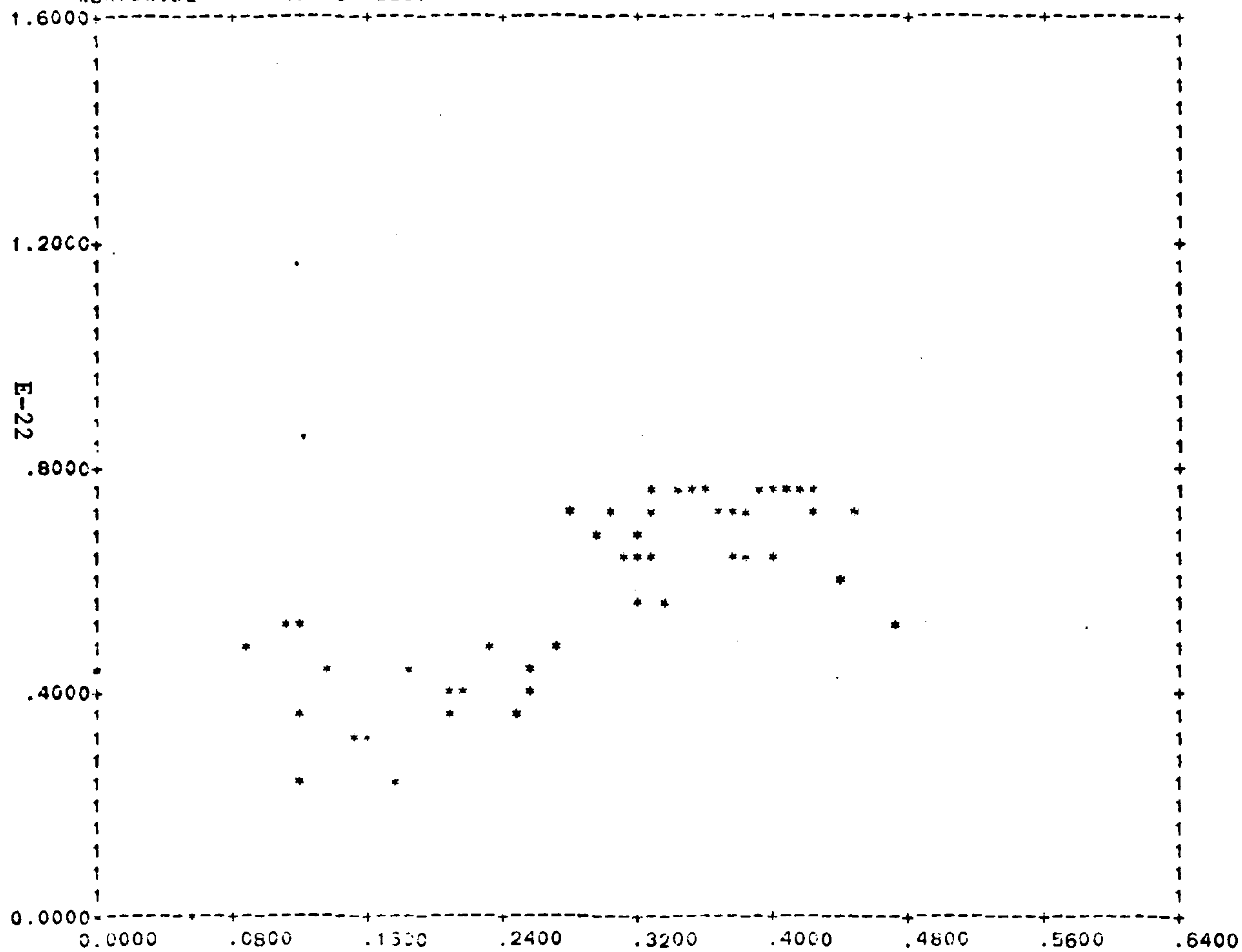


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.09618402410339	MS=	.09618402410339
RESIDUAL	DF=	28.	SS=	.6249754425633	MS=	.02232055152012
TOTAL	DF=	29.	SS=	.7211594666667		

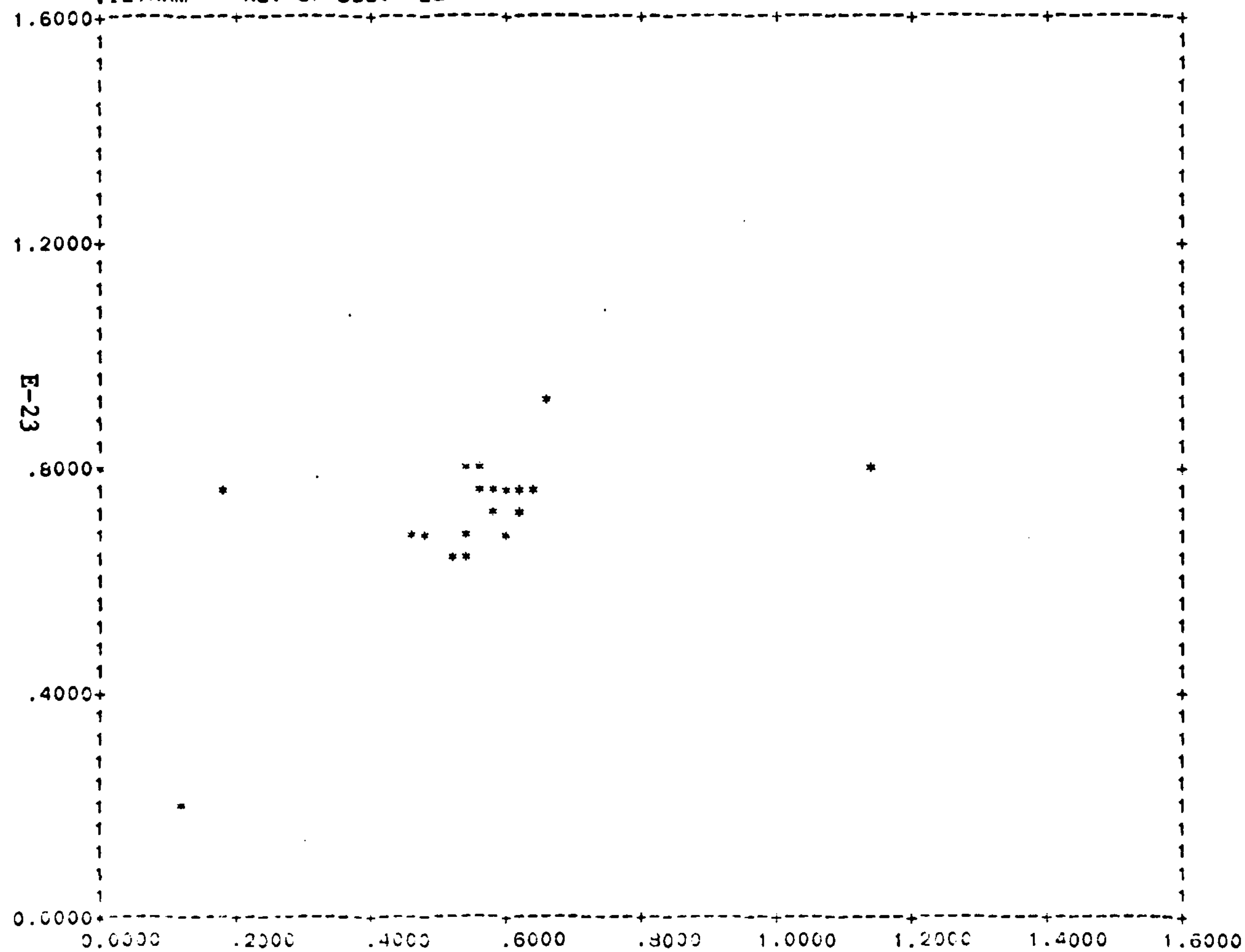
F-TEST= 4.30921[illegible]7016
R**2= 13.3[illegible]
CORRELATION EST= -.36[illegible]0487
S= .1494[illegible]09629
SLOPE EST= -4.156[illegible]
INTERCEPT EST= 1.[illegible]98181217

```
SYSTEM=AH-1
      YVARIABLE=                     AVERAGE RELIABILITY
      XVARIABLE=                     AVERAGE LENGTH OF SORTIES BY AIRCRAFT
   WORLDWIDE        NO. OF OBS. =54
```




```
    ANOVA TABLE
REGRESSION     DF=   1.   SS=   .8252620922846   MS=   .8252620922846
RESIDUAL       DF=   52.  SS=   .5332993891968   MS=   .01025575748455
TOTAL          DF=   53.  SS=   1.3585614814B1
F-TEST=   80.16817541537
R**2=   60.7452685669     CORRELATION EST=    .7793526389625
S=   .1012707138543
SLOPE EST=   1.202047546351      INTERCEPT EST=    .2303117378555
```

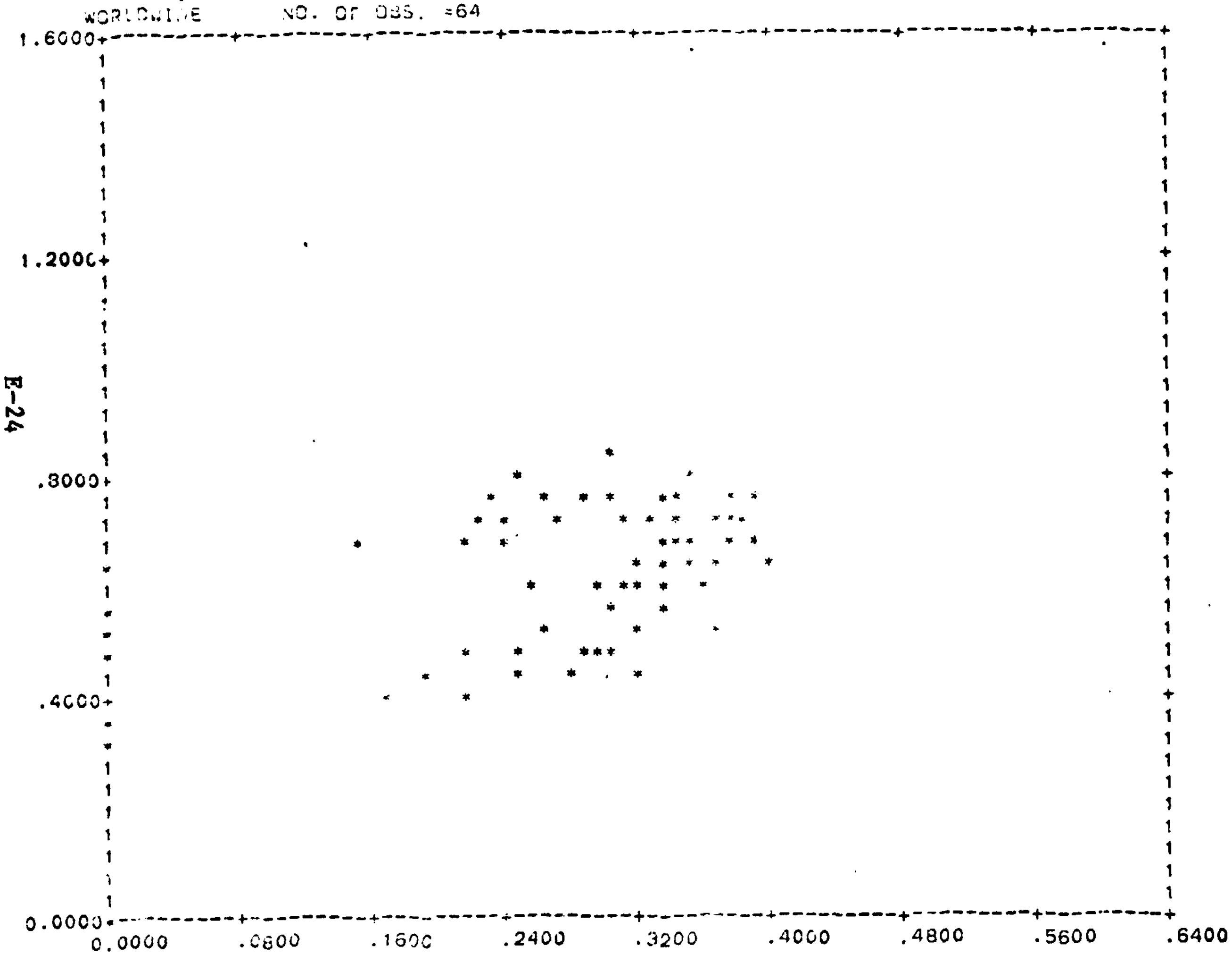
SYSTEM: AH-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =22



ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  .1231598514781   MS=  .1231598514781
RESIDUAL     DF= 20.   SS=  .244450321249    MS=  .0122225460624б
TOTAL        DF= 21.   SS=  .367[illegible]07727273
F-TEST=  10.0764481351B
R**2=  33.502[illegible]   CORRELATION EST=  .57[illegible]59143125
S=  .110556242914
SLOPE EST=  .4[illegible]914966985[illegible]   INTERCEPT EST=  .48[illegible]7459704
```

SYSTEM=CH47
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =64

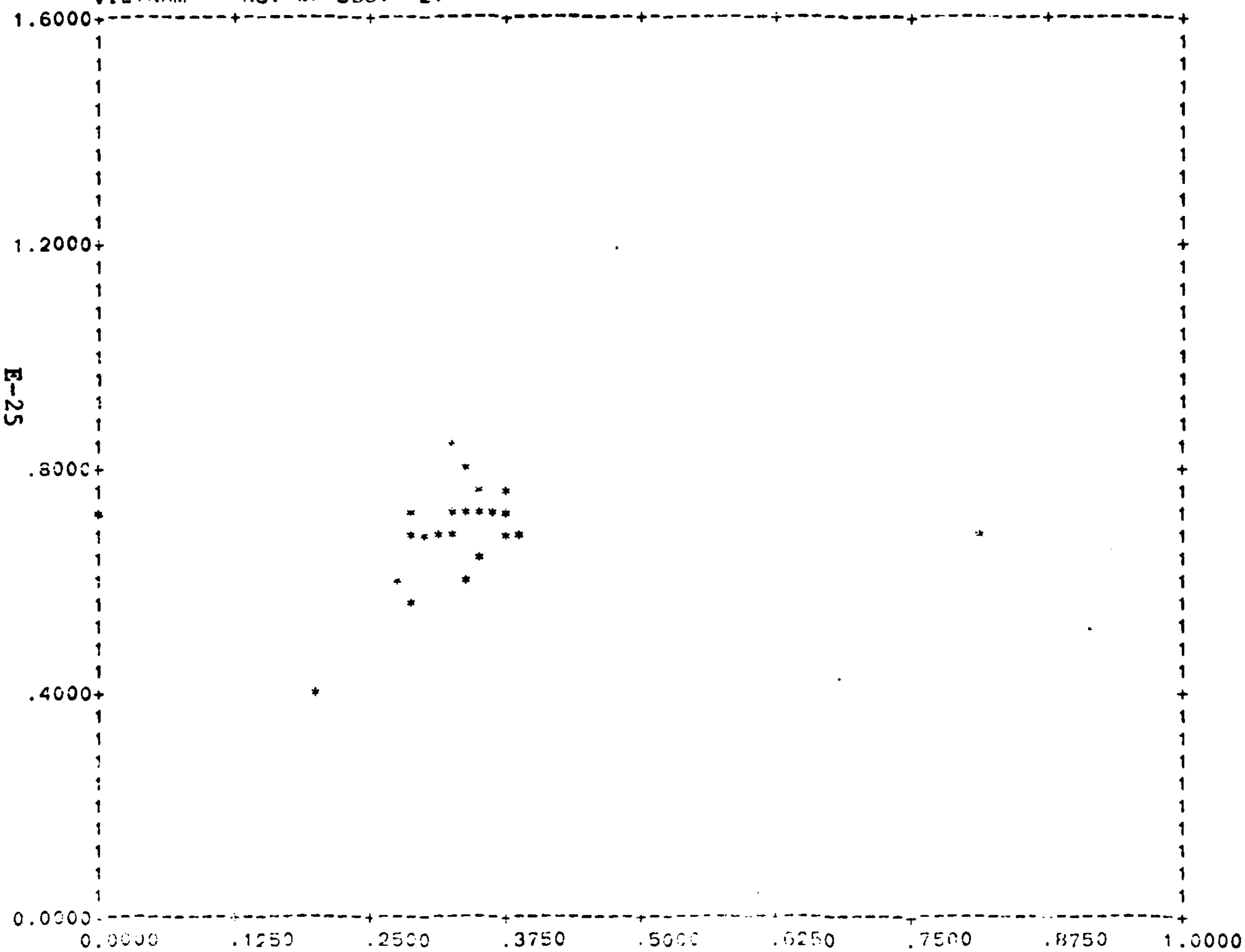


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.09185089968268	MS=	.09185089968268
RESIDUAL	DF=	62.	SS=	.6834128503173	MS=	.01102278790834
TOTAL	DF=	63.	SS=	.77526375		

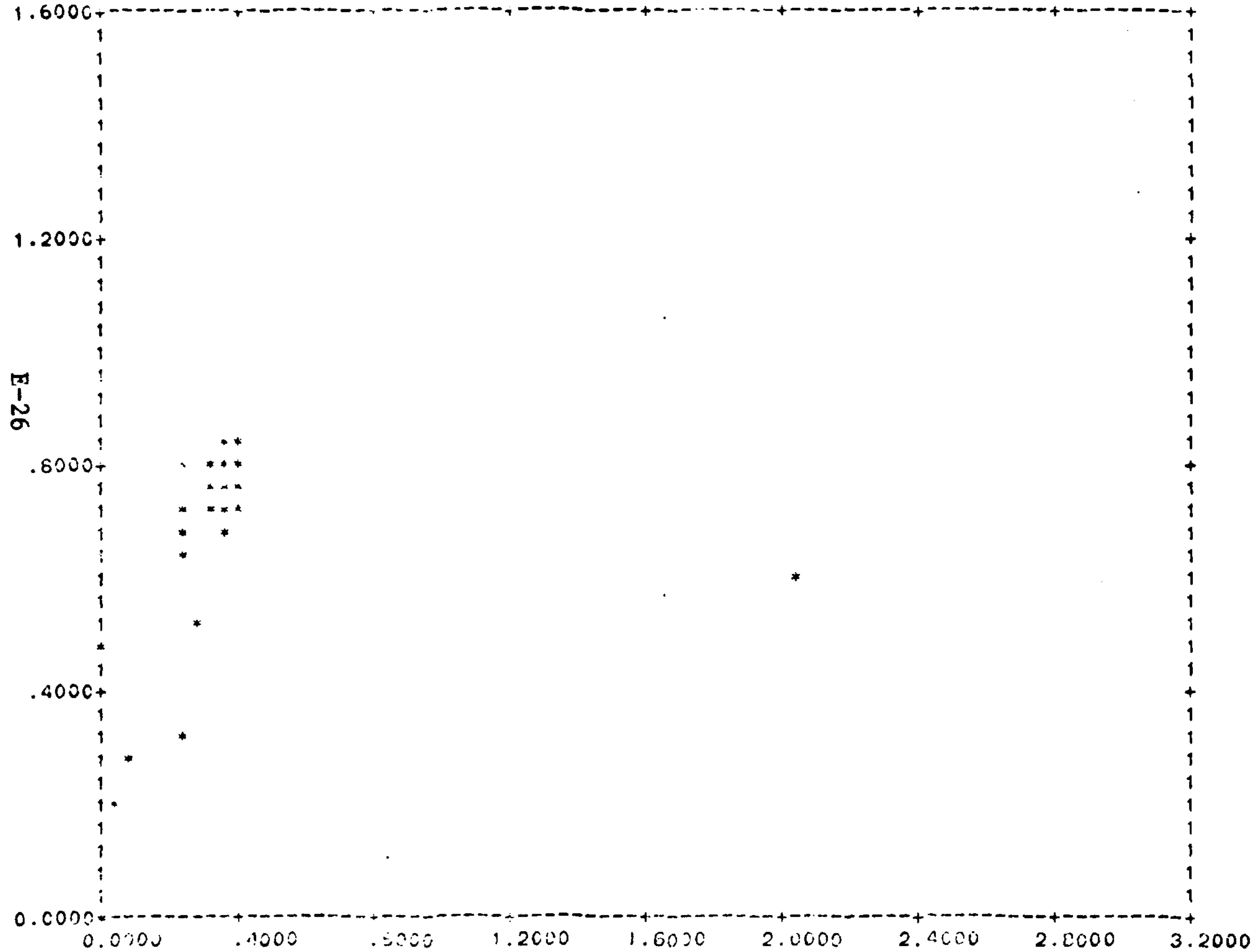
F-TEST= 8.33281928732
R**2= 11.84769695251 CORRELATION EST= .3442048365801
S= .1049894657018
SLOPE EST= .6540753331643 INTERCEPT EST= .440192970531

```
SYSTEM=CH47
     YVARIABLE=                    AVERAGE RELIABILITY
     XVARIABLE=                    AVERAGE LENGTH OF SORTIES BY AIRCRAFT
   VIETNAM     NO. OF OBS. =27
```




```
   ANOVA TABLE
REGRESSION     DF=   1.    SS=   .00879255549[illegible]868   MS=   .00879255549[illegible]368
RESIDUAL       DF=   25.   SS=   .1[illegible]28111[illegible]  MS=   .00[illegible]12[illegible]446[illegible]
TOTAL          DF=   26.   SS=   .1[illegible]066667
F-TEST=   1.2718042[illegible]
R**2=   [illegible]4043[illegible]52     CORRELATION EST=    .22[illegible]75772
S=   .0[illegible]
SLOPE EST=   .1[illegible]50274207     INTERCEPT EST=   .[illegible]8740[illegible]
```

SYSTEM=C-5A
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =47

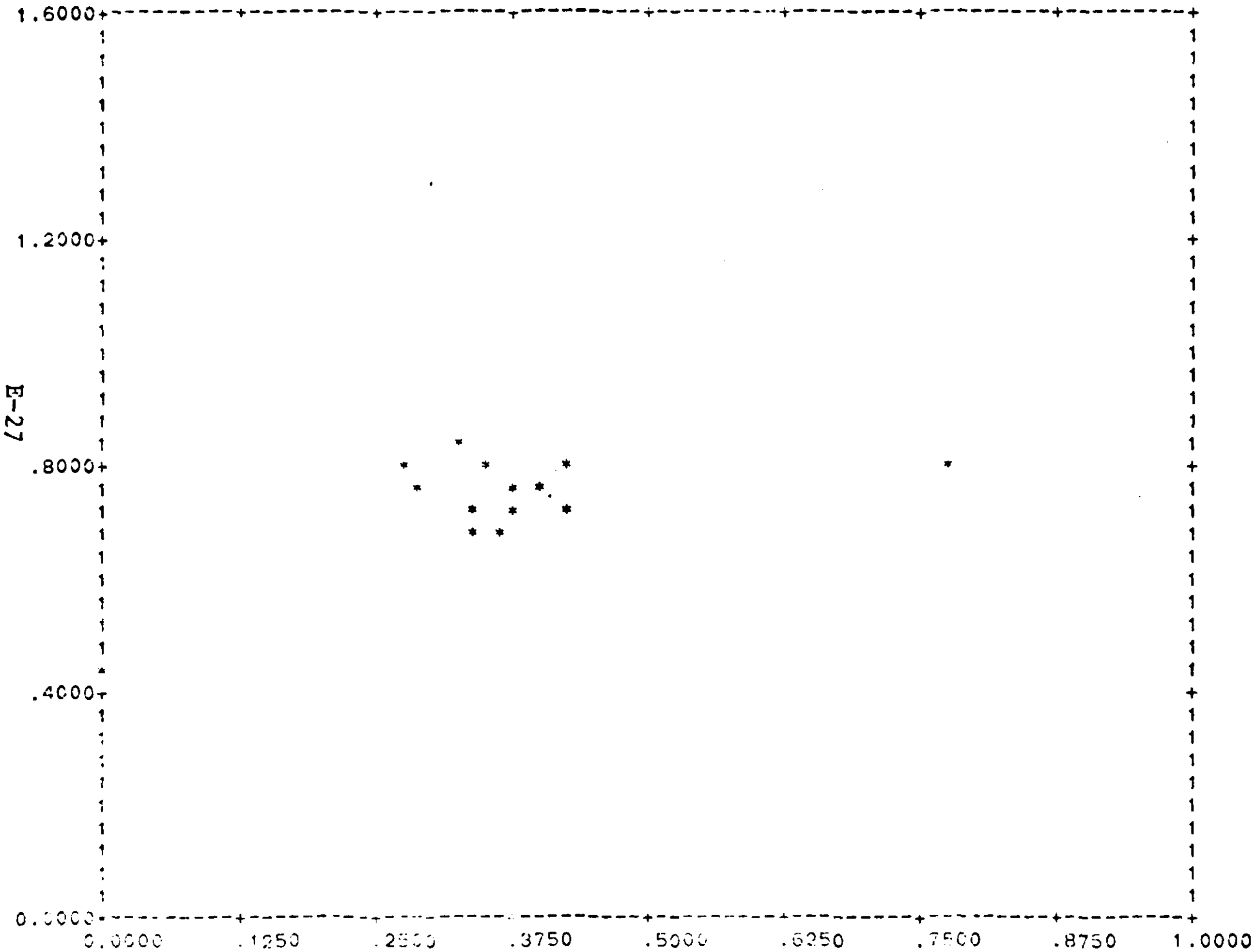


ANOVA TABLE

REGRESSION	DF= 1.	SS= .01230659576877	MS= .01230659576877
RESIDUAL	DF= 45.	SS= .865221361676	MS= .019227141370664
TOTAL	DF= 46.	SS= .8775279574468	

F-TEST= .640063727184
R**2= 1.402410374811 CORRELATION EST= .118423621124
S= .1386619680036
SLOPE EST= .06271990636553 INTERCEPT EST= .7046300057492

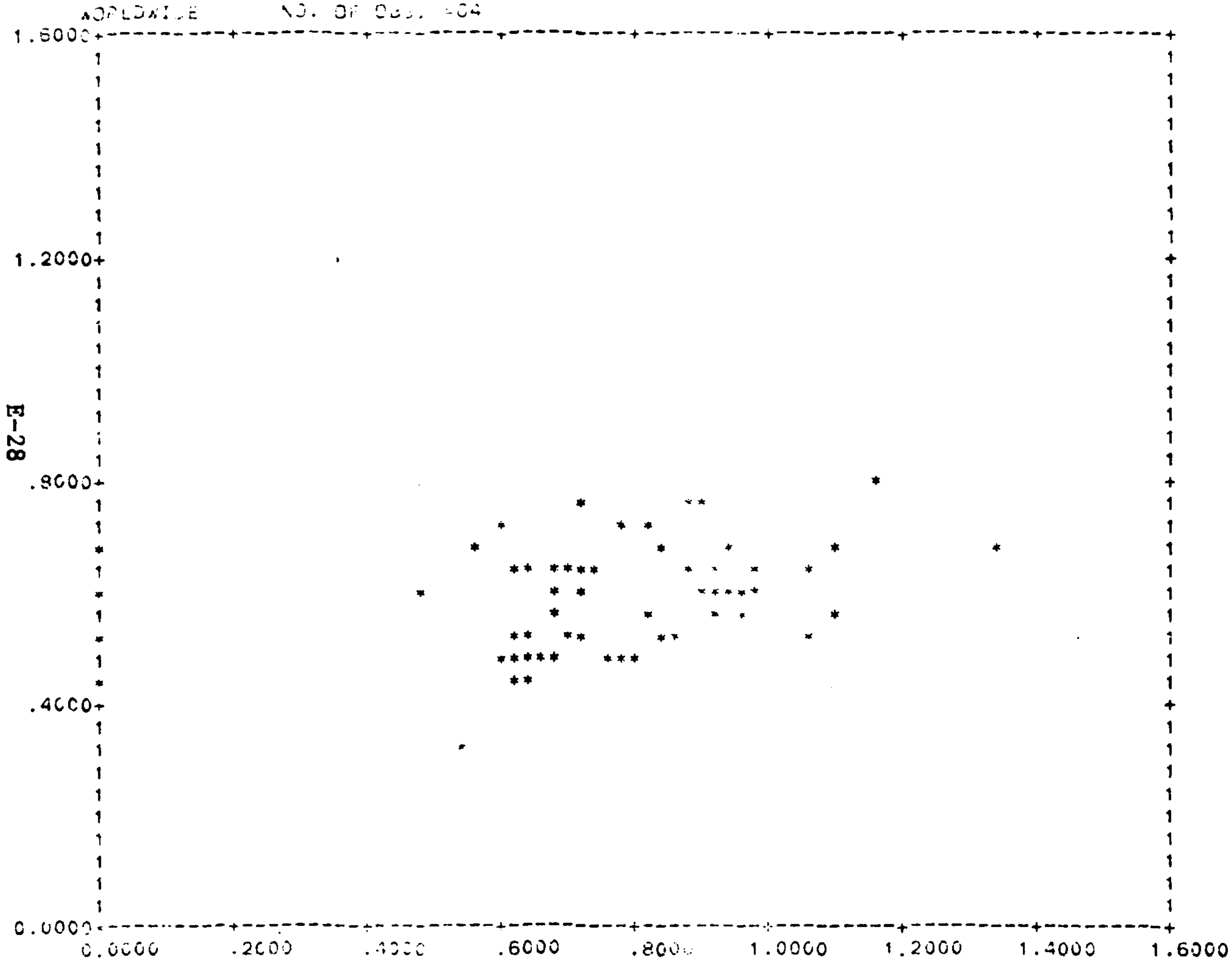
SYSTEM=0058
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =13



ANOVA TABLE

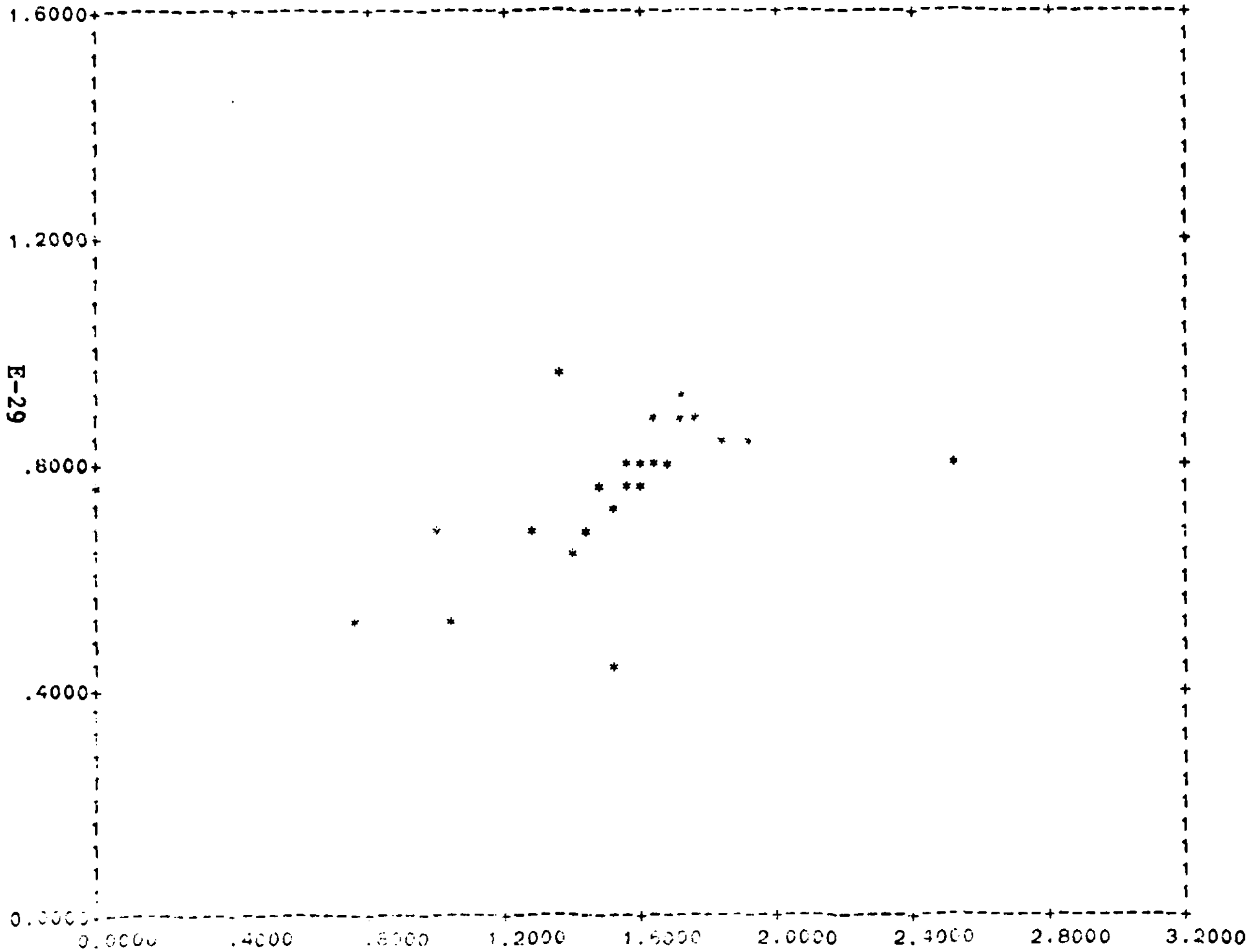
```
REGRESSION   DF=  1.   SS=  .0001945264162464   MS=  .0001945264162464
RESIDUAL     DF= 11.   SS=  .0315831658914 5    MS=  .002872105990131
TOTAL        DF= 12.   SS=  .0317776923076 9
F-TEST=  .06772953954961
R**2=  .0061 21477415      CORRELATION EST=  .07822 49475
S=  .0535920318 792
SLOPE EST=  .0327600034724     INTERCEPT EST=  .7420 790187
```

```
SYSTEM-OV-1
     YVARIABLE=                    AVERAGE RELIABILITY
     XVARIABLE=                    AVERAGE LENGTH OF SORTIES BY AIRCRAFT
   WORLDWIDE        NO. OF OBS. 64
```



```
    ANOVA TABLE
REGRESSION     DF=   1.    SS=   .09746137253908    MS=    .09746137253908
RESIDUAL       DF=   62.   SS=   .4498550649609     MS=    .007255726854208
TOTAL          DF=   63.   SS=   .5473164375
F-TEST=    13.43233759621
R**2=    17.8071342027      CORRELATION EST=     .4219[illegible]021352
S=    .08513059443703
SLOPE EST=    .230796019736       INTERCEPT EST=    .3978577120566
```

SYSTEM=OV-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =28

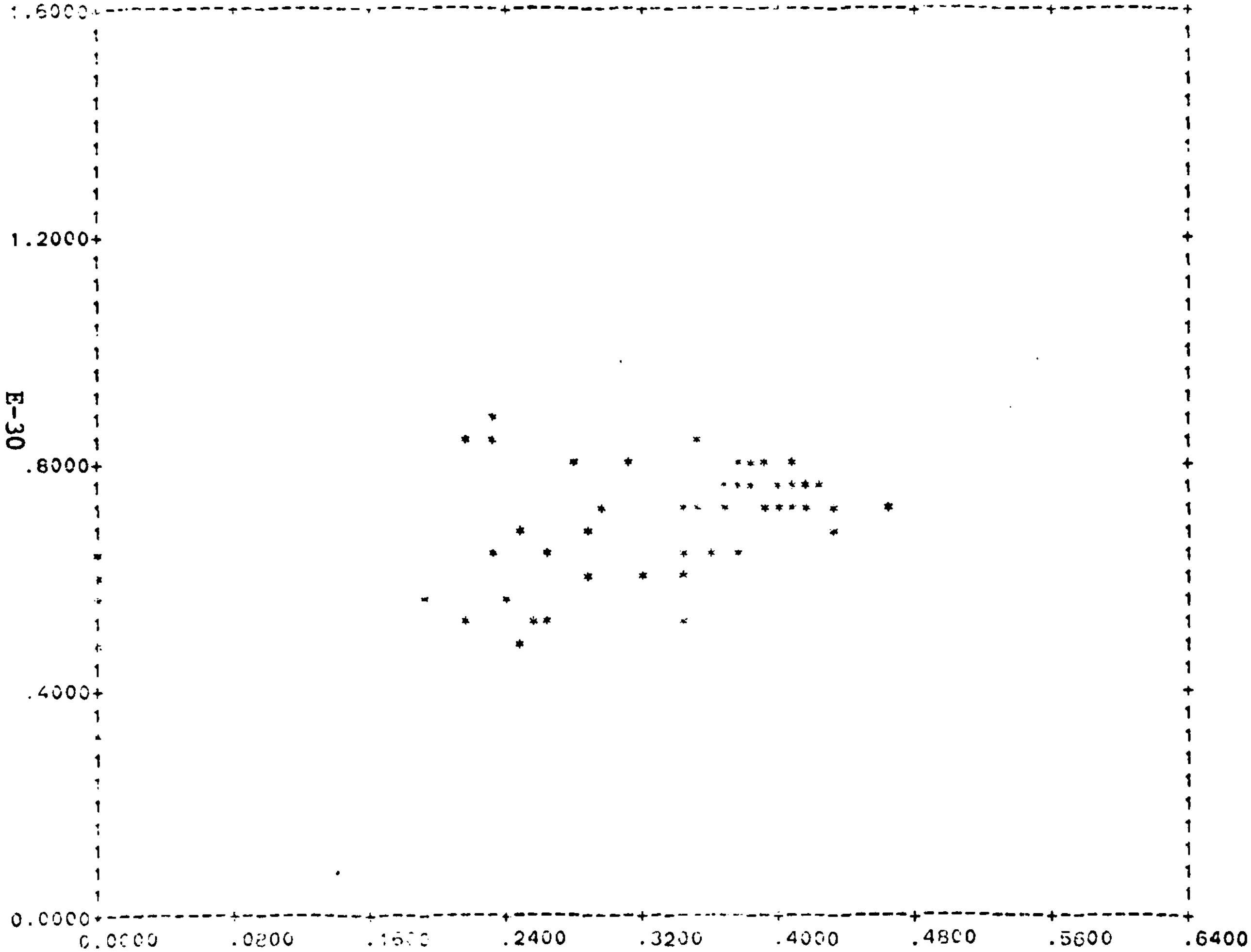


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.1401677146707	MS=	.1401677146707
RESIDUAL	DF=	26.	SS=	.283143249615	MS=	.0108901249851[illegible]
TOTAL	DF=	27.	SS=	.4233109642857		

F-TEST= 12.[illegible]8411165
R**2= [illegible]2[illegible]3464 CORRELATION EST= .575[illegible]021354
S= .1043557[illegible]1[illegible]
SLOPE EST= .227[illegible]9049718 INTERCEPT EST= .4073[illegible]464465

SYSTEM=UH-1
Y-VARIABLE=   AVERAGE RELIABILITY
X-VARIABLE=   AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE   NO. OF OBS. =64

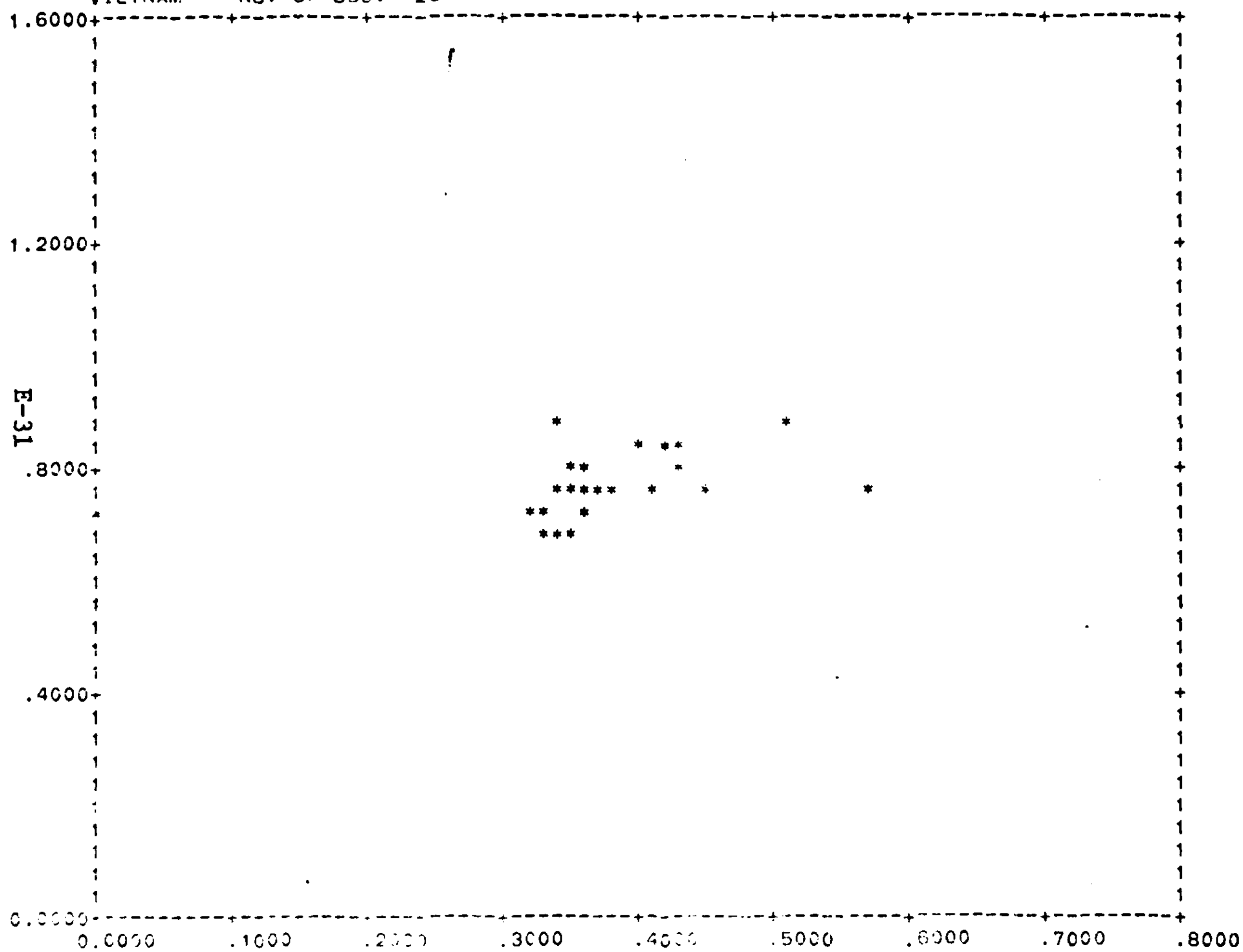


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.1228267080826	MS=	.1228267080826
RESIDUAL	DF=	62.	SS=	.4904812294174	MS=	.0079109875571248
TOTAL	DF=	63.	SS=	.6133079375		

F-TEST= 15.52609048712
R**2= 20.0283229489 CORRELATION EST= .4475145019874
S= .08894375261365
SLOPE EST= .6530488217394 INTERCEPT EST= .4613097324421

```
SYSTEM=UH-1
      YVARIABLE=                    AVERAGE RELIABILITY
      XVARIABLE=                    AVERAGE LENGTH OF SORTIES BY AIRCRAFT
    VIETNAM     NO. OF OBS. =29
```



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    ANOVA TABLE
REGRESSION     DF=   1.   SS=  .01593816663458   MS=  .01593816663458
RESIDUAL       DF=  27.   SS=  [illegible]266095162   MS=  .002173802257468
TOTAL          DF=  28.   SS=  [illegible]002758621
F-TEST=   7.33[illegible]
R**2=   21.2[illegible]
S=   .046[illegible]
SLOPE EST=   .42[illegible]        INTERCEPT EST=   [illegible]1204983
```
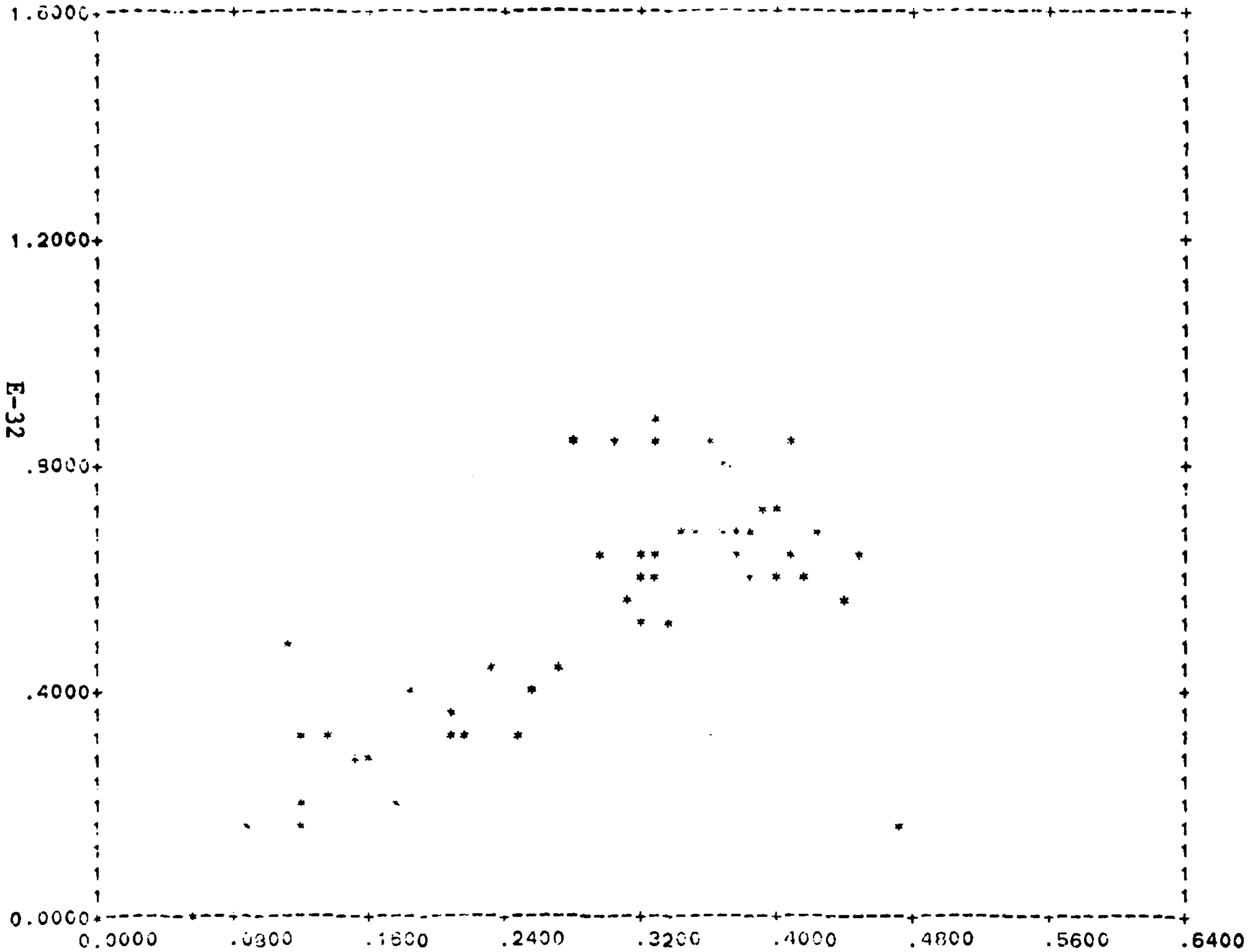
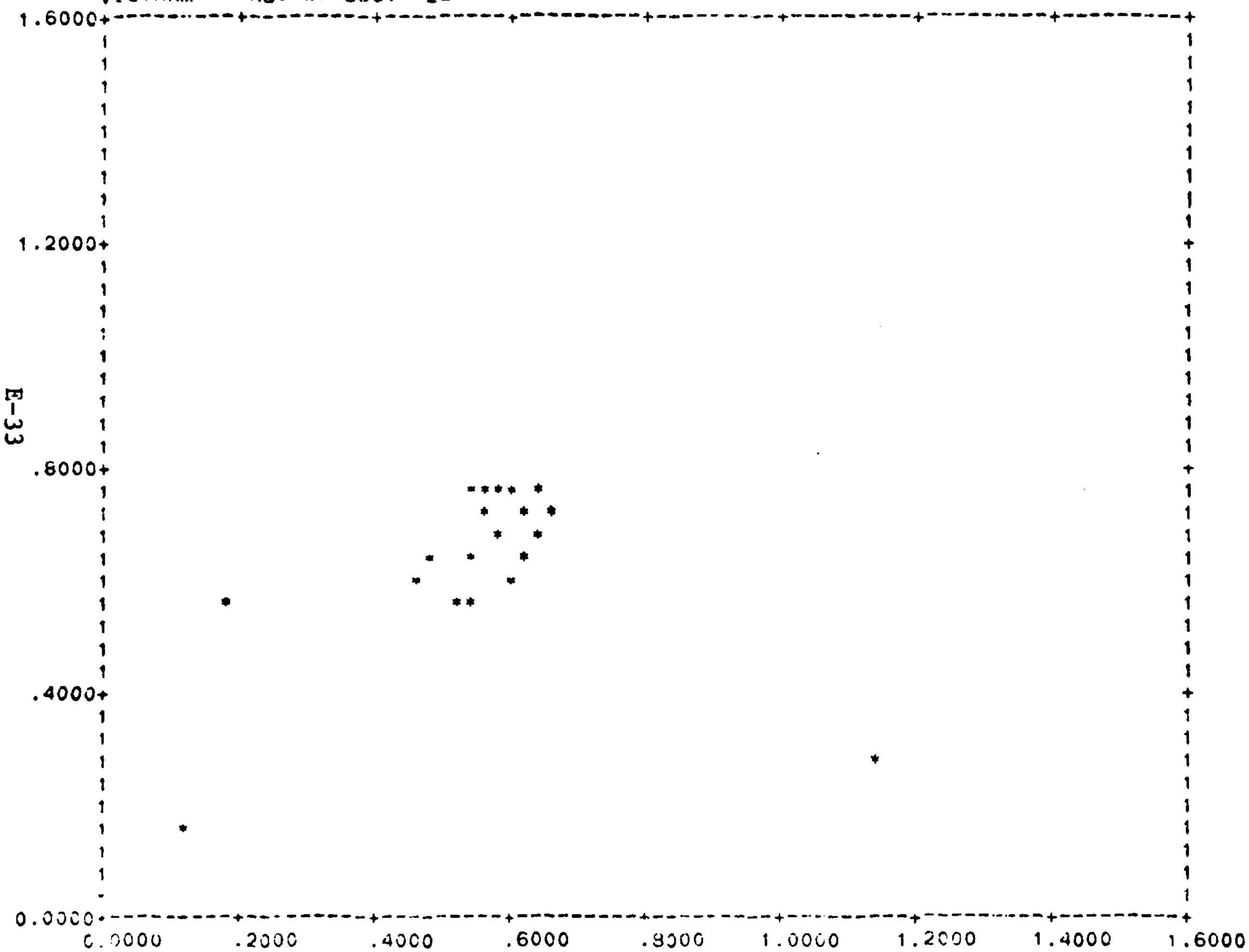

SYSTEM=AH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =54



ANOVA TABLE

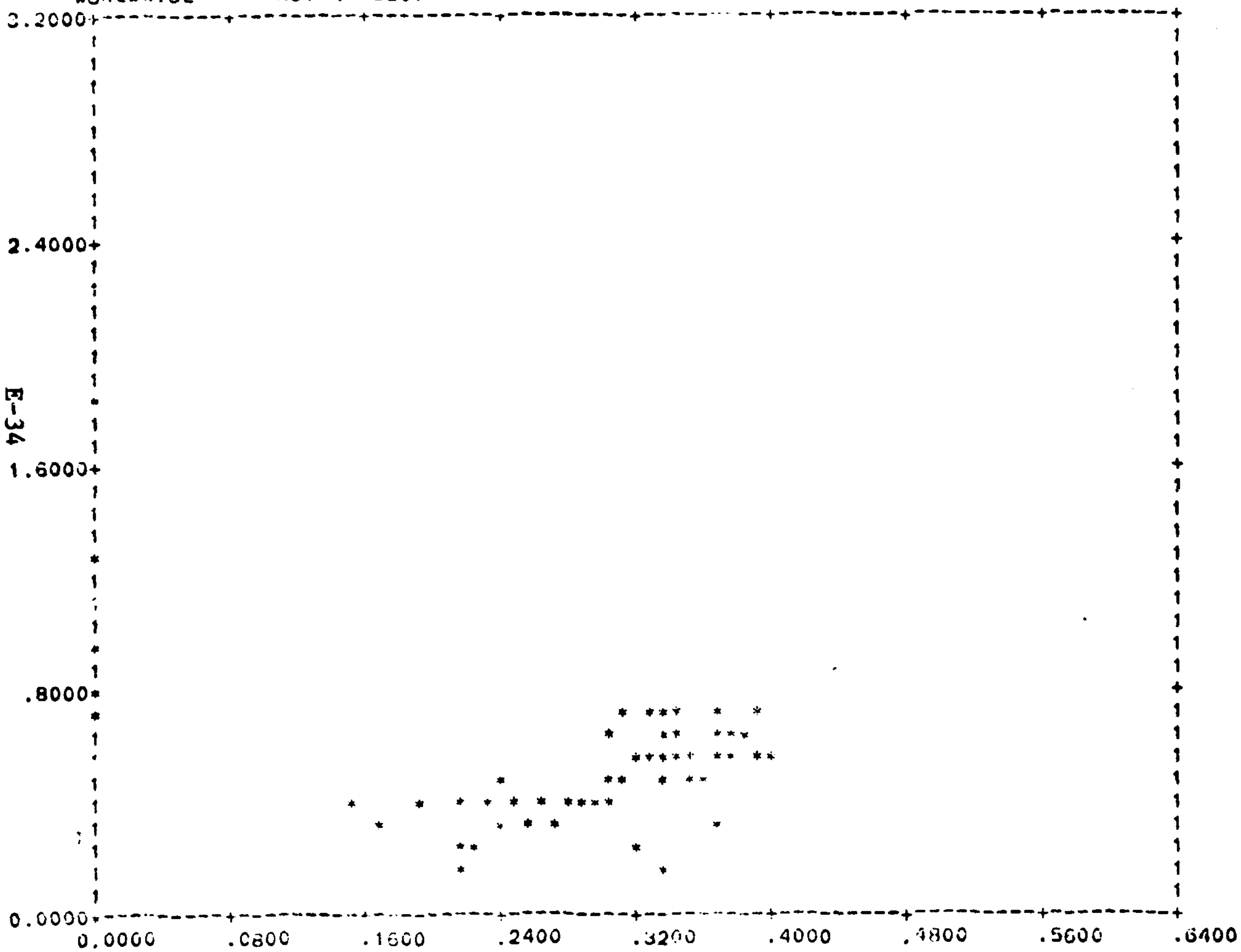
```
REGRESSION   DF=   1.   SS=   1.058825677008   MS=   1.058825677008
RESIDUAL     DF=  52.   SS=   1.152119656326   MS=    .02215614723703
TOTAL        DF=  53.   SS=   2.210945333333
F-TEST=   47.78925079709
R**2=   47.89017795753      CORRELATION EST=    .6920273041401
S=   .1488494112754
SLOPE EST=   1.361563593112      INTERCEPT EST=   .1566924014587
```

SYSTEM=AH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =22



ANOVA TABLE
REGRESSION DF= 1. SS= .004878512180105 MS= .004878512180105
RESIDUAL DF= 20. SS= .4746387605472 MS= .02374193802736
TOTAL DF= 21. SS= .4795172727273
F-TEST= .19705068777[illegible]
R**2= [illegible]2523009 CORRELATION EST= [illegible]
S= .1540[illegible]361
SLOPE EST= .03100322040701 INTERCEPT EST= [illegible]1260865

SYSTEM-CH47
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =64



ANOVA TABLE

REGRESSION	DF= 1.	SS= .5239691161834	MS= .5239691161834
RESIDUAL	DF= 62.	SS= .8288926338166	MS= .0133692360293
TOTAL	DF= 63.	SS= 1.35286175	

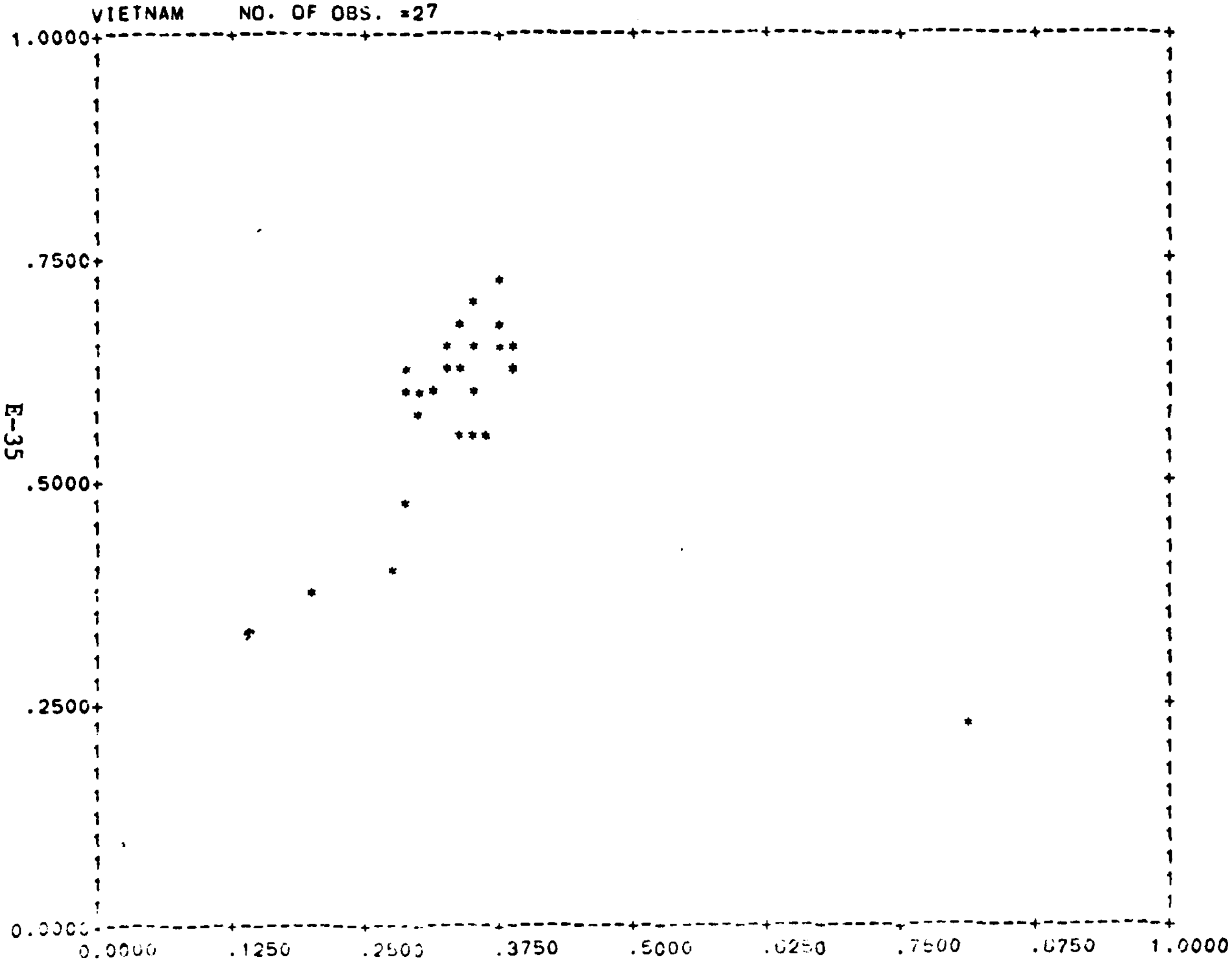
F-TEST= 39.19215092284
R**2= 38.73042579431 CORRELATION EST= .6223377062358
S= .1156254125584
SLOPE EST= 1.562208183765 INTERCEPT EST= .0121387267024

SYSTEM=CH47

YVARIABLE= AVERAGE AVAILABILITY

XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT

VIETNAM NO. OF OBS. =27



ANOVA TABLE

REGRESSION	DF=	1.	SS=	.05014361726346	MS=	.05014361726346
RESIDUAL	DF=	25.	SS=	.2453520123662	MS=	.009814080494547
TOTAL	DF=	26.	SS=	.2954956296296		

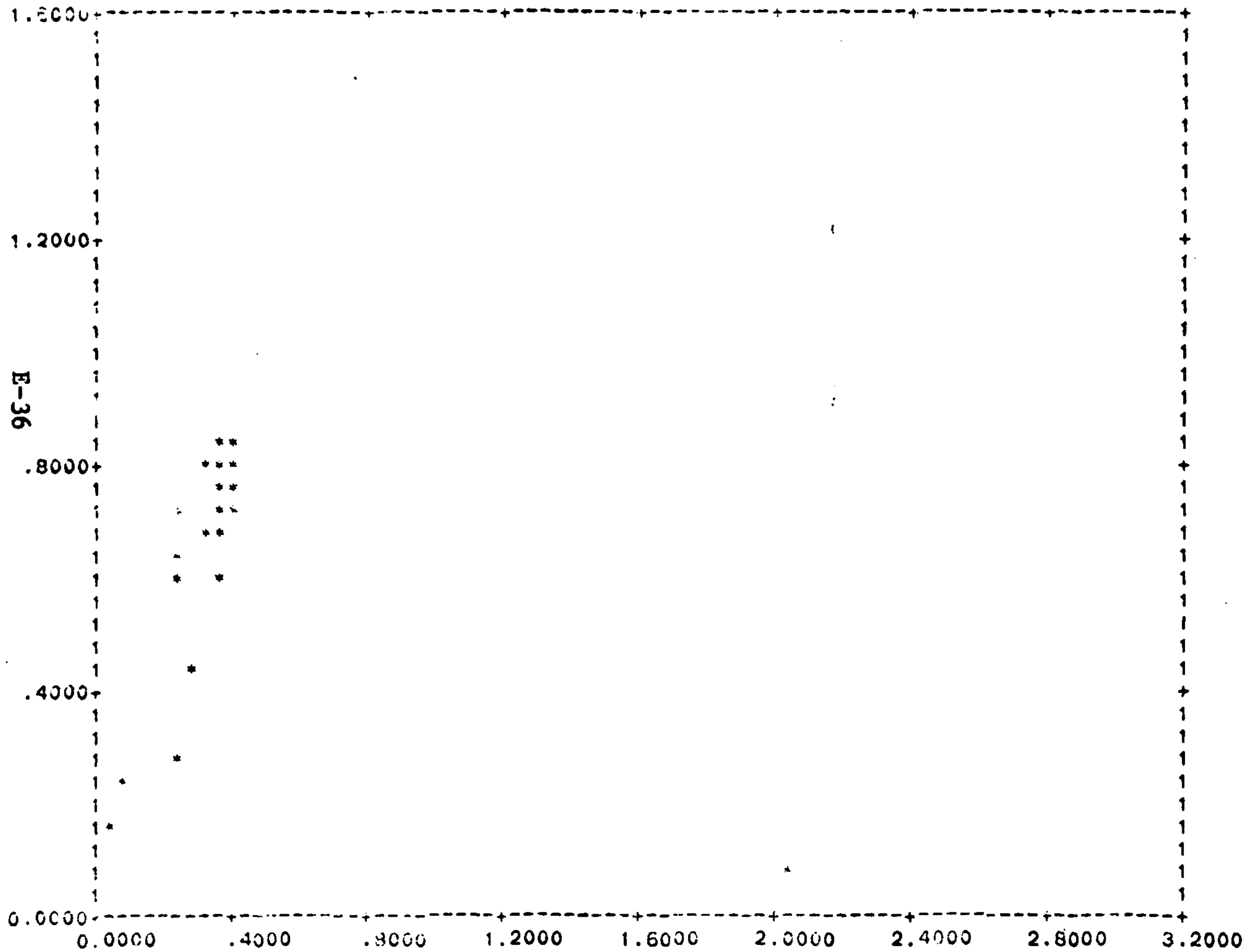
F-TEST= 5.10935459423

R**2= 16.[illegible] CORRELATION EST= -.41[illegible]00109

S= .0000[illegible]4107086

SLOPE EST= -.4258319927651 INTERCEPT EST= .7[illegible]110273714

SYSTEM=OH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =47

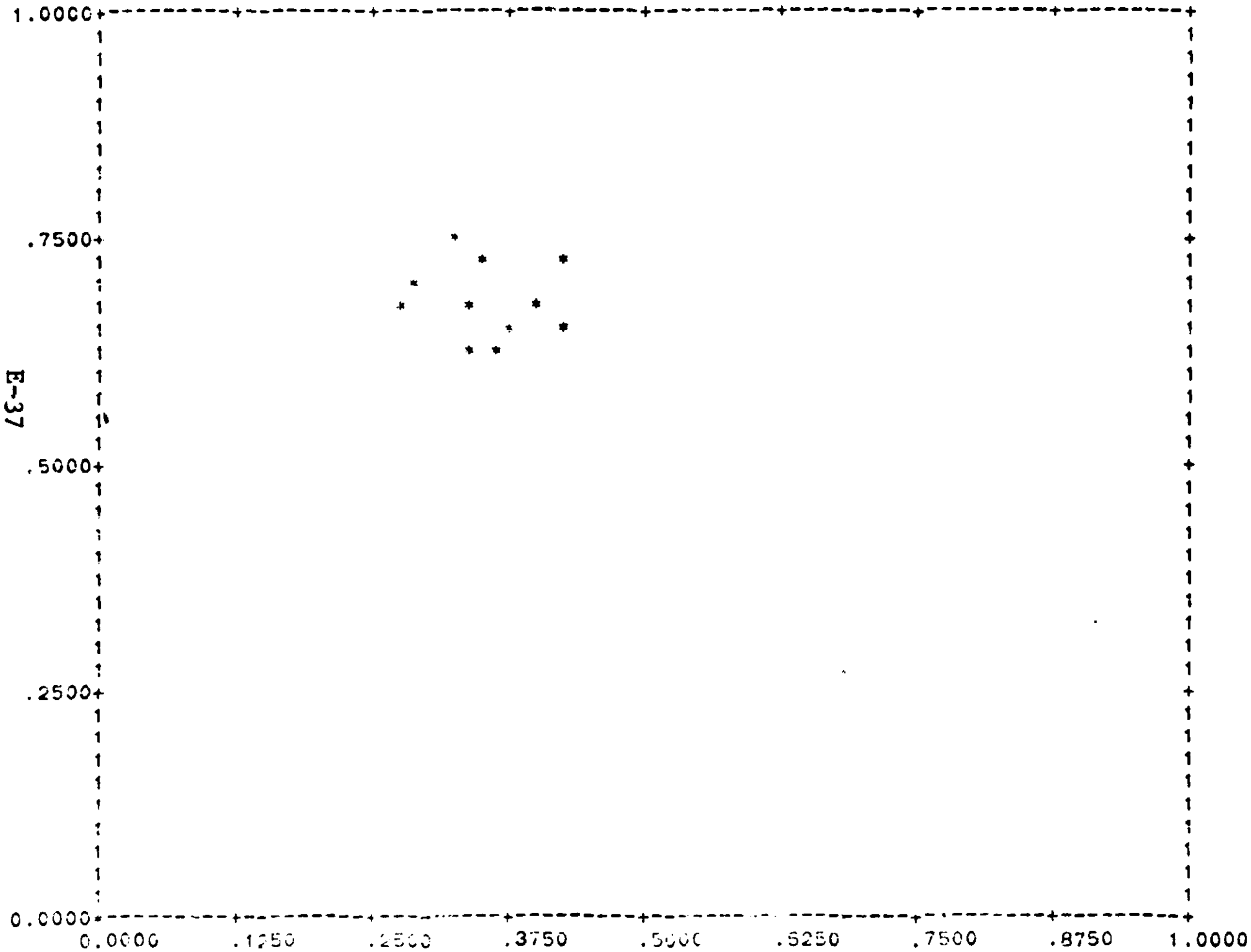


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.1426520882684	MS=	.1426520882684
RESIDUAL	DF=	45.	SS=	1.226922847902	MS=	.02726495217559
TOTAL	DF=	46.	SS=	1.36957493617		

F-TEST= 5.232068163909
R**2= 10.41579284937 CORRELATION EST= -.3227350747857
S= .1651210228154
SLOPE EST= -.2135381620083 INTERCEPT EST= .767816948239

SYSTEM=OH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =12

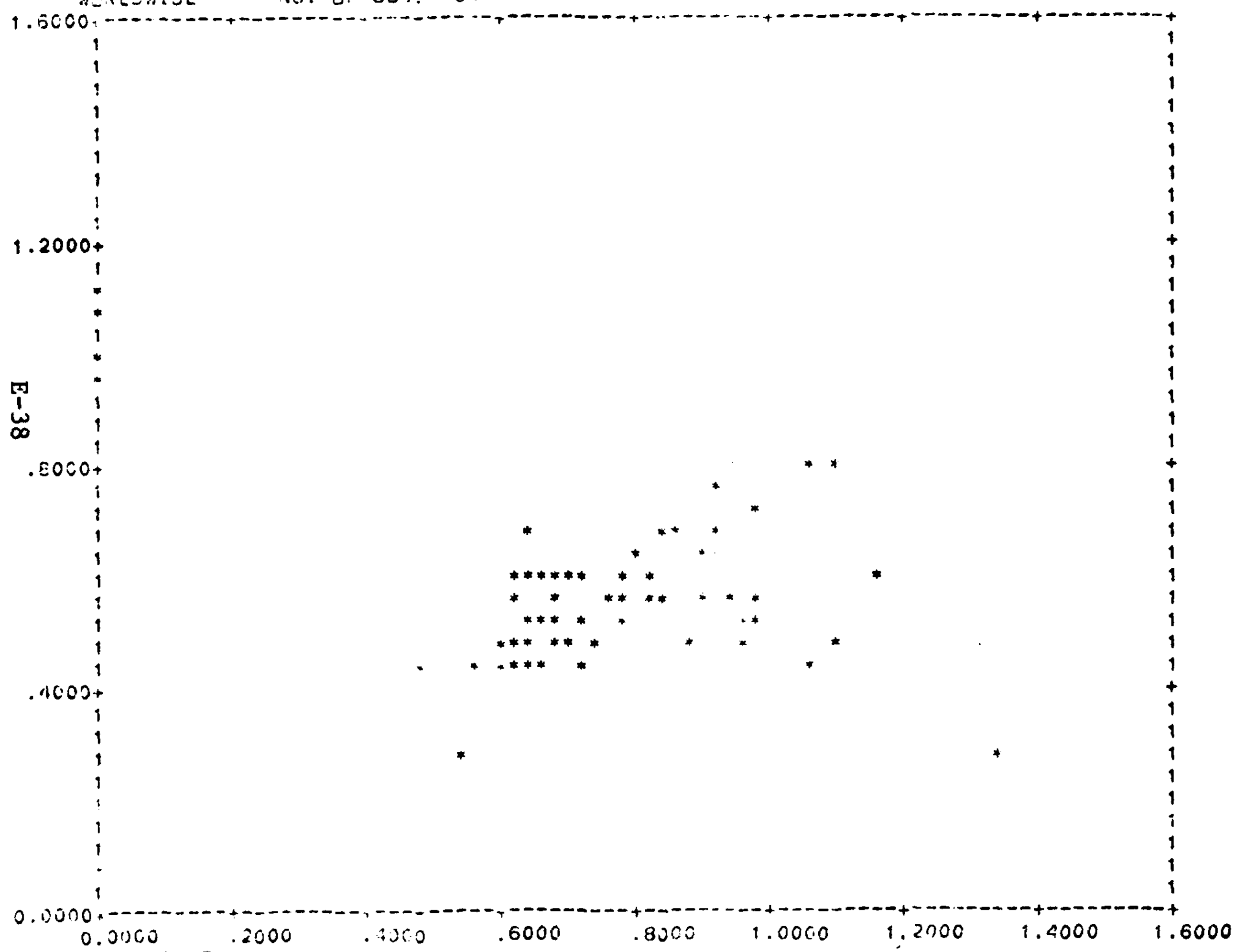


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.00055187430725 49	MS=	.0005518743072549
RESIDUAL	DF=	10.	SS=	.01759612569275	MS=	.001759612569275
TOTAL	DF=	11.	SS=	.018158		

F-TEST= [illegible]
R**2= 3.[illegible]52504521 CORRELATION EST= -.175[illegible]59672
S= .041[illegible]
SLOPE EST= -.149[illegible]55214302 INTERCEPT EST= .[illegible]4300707625

SYSTEM=C-141
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. =64

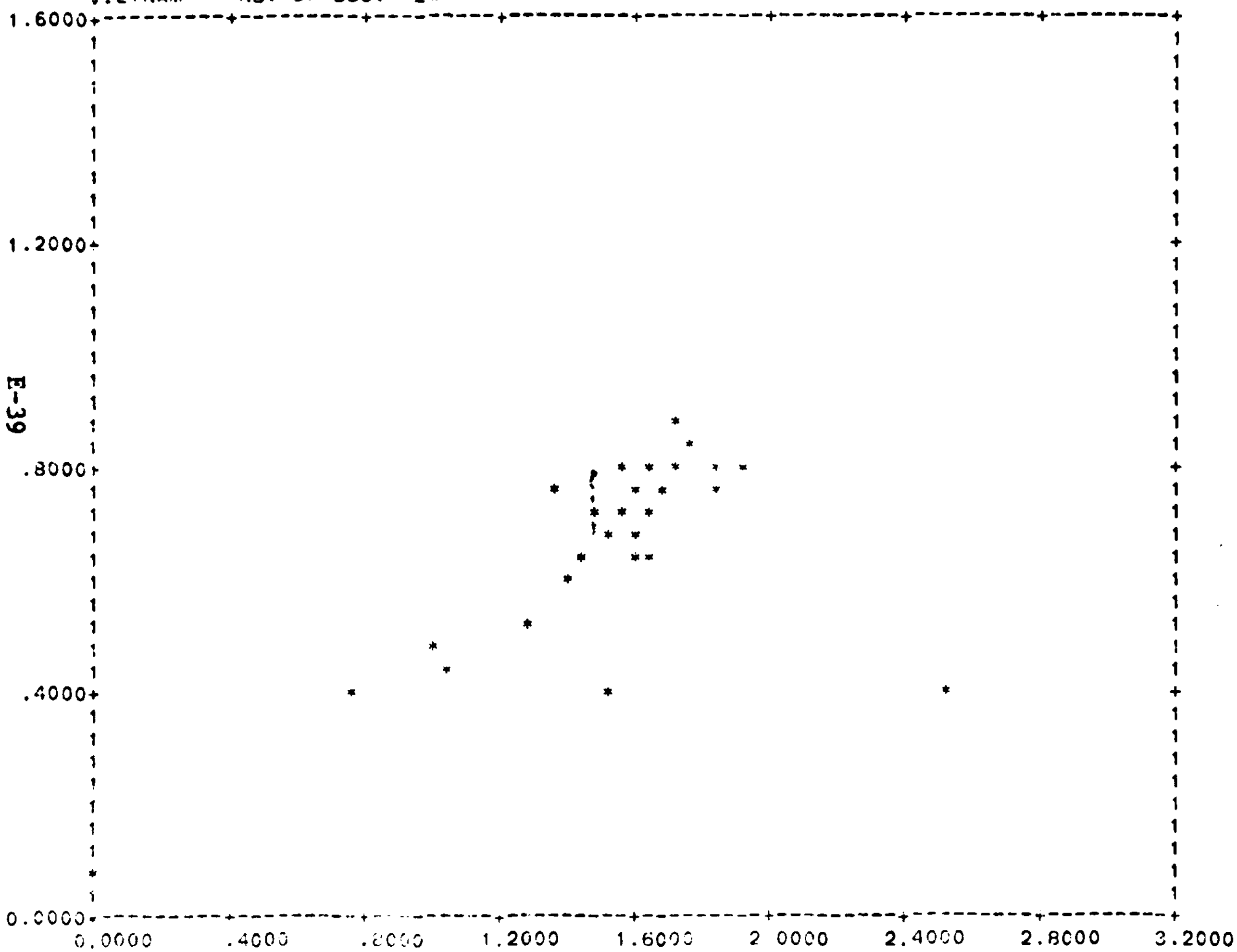


ANOVA TABLE

REGRESSION	DF= 1.	SS= .0666092553246 3	MS= .0666092553246 3
RESIDUAL	DF= 62.	SS= .5854601821754	MS= .009442906164119
TOTAL	DF= 63.	SS= .6520694375	

F-TEST= 7.053893506628
R**2= 10.21505555311 CORRELATION EST= .3196100054616
S= .09717461667148
SLOPE EST= .1907374173605 INTERCEPT EST= .3946306161281

SYSTEM=OV-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =28

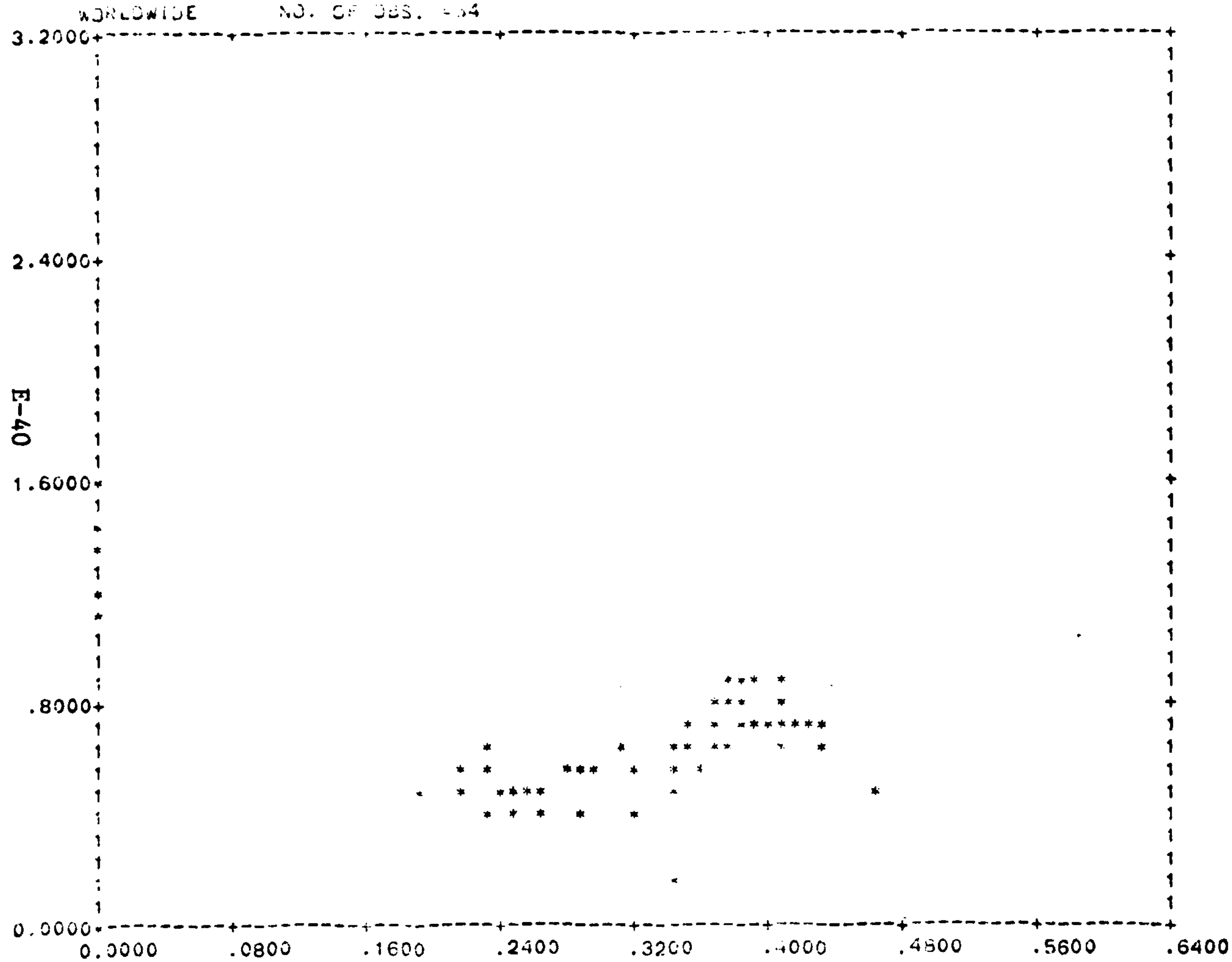


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.06692760159961	MS=	.06692760159961
RESIDUAL	DF=	26.	SS=	.4305131126861	MS=	.01655819664177
TOTAL	DF=	27.	SS=	.4974407142857		

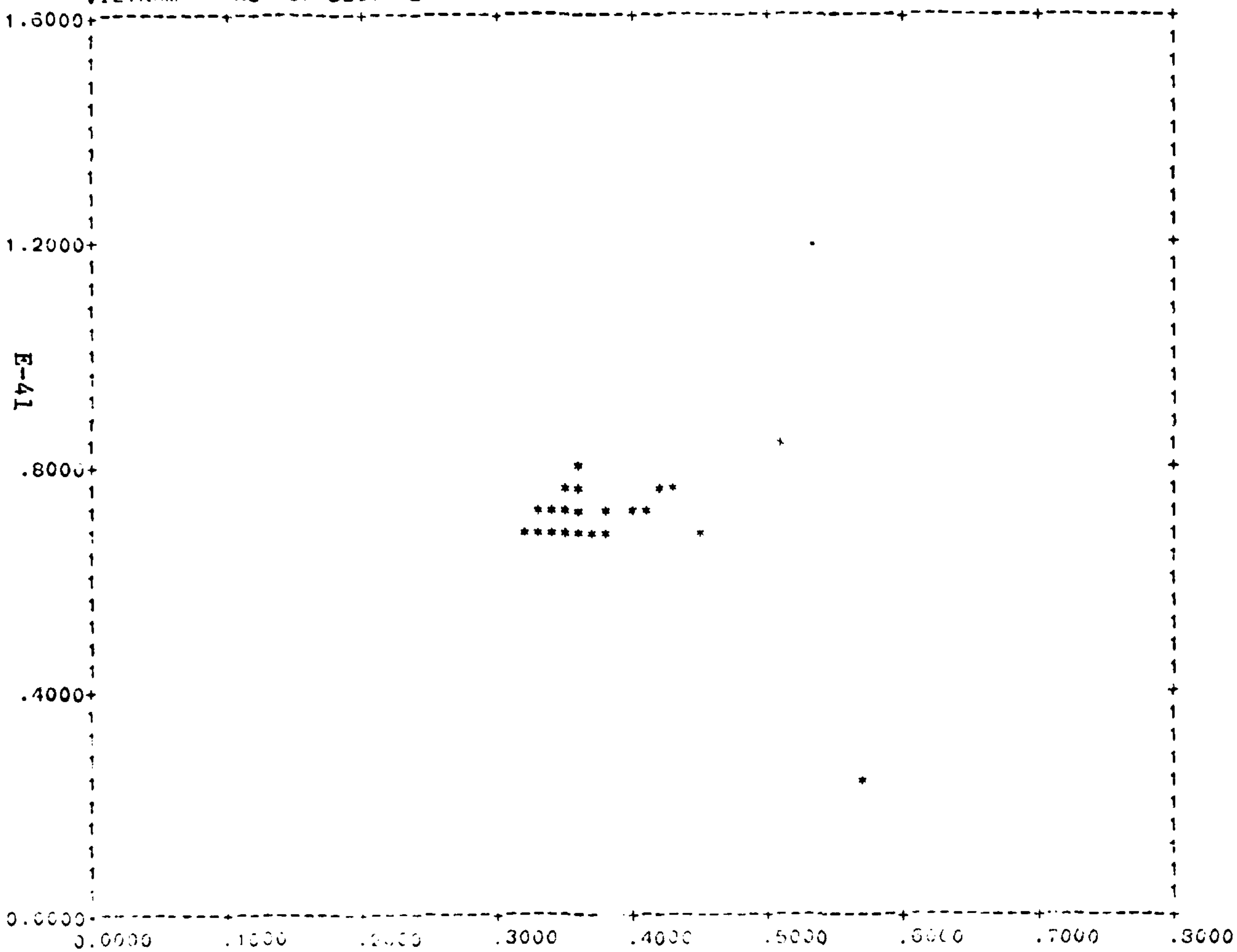
F-TEST= 4.04196199076
R**2= 13.45438756369 CORRELATION EST= .36680229590C5
S= .1286780565122
SLOPE EST= .1574769743133 INTERCEPT EST= .4207765859799

SYSTEM-UNIT
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
WORLDWIDE NO. OF OBS. 64



```
ANOVA TABLE
REGRESSION   DF=   1.   SS=  .6004624692565   MS=  .6004624692565
RESIDUAL     DF=  62.   SS=  .7591632807435   MS=  .01224456904425
TOTAL        DF=  63.   SS=  1.35962575
F-TEST=   49.03908558244
R**2=   44.16380531602      CORRELATION EST=    .6645585400552
S=  .1103551808288
SLOPE EST=   1.443919228334      INTERCEPT EST=   .135168547496
```

SYSTEM=UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
VIETNAM NO. OF OBS. =29



ANOVA TABLE

REGRESSION	DF= 1.	SS= .03700405203021	MS=	.0[illegible]0905203021
RESIDUAL	DF= 27.	SS= .2207363962456	MS=	.00[illegible]6533194[illegible]3
TOTAL	DF= 28.	SS= .2[illegible]454432759		

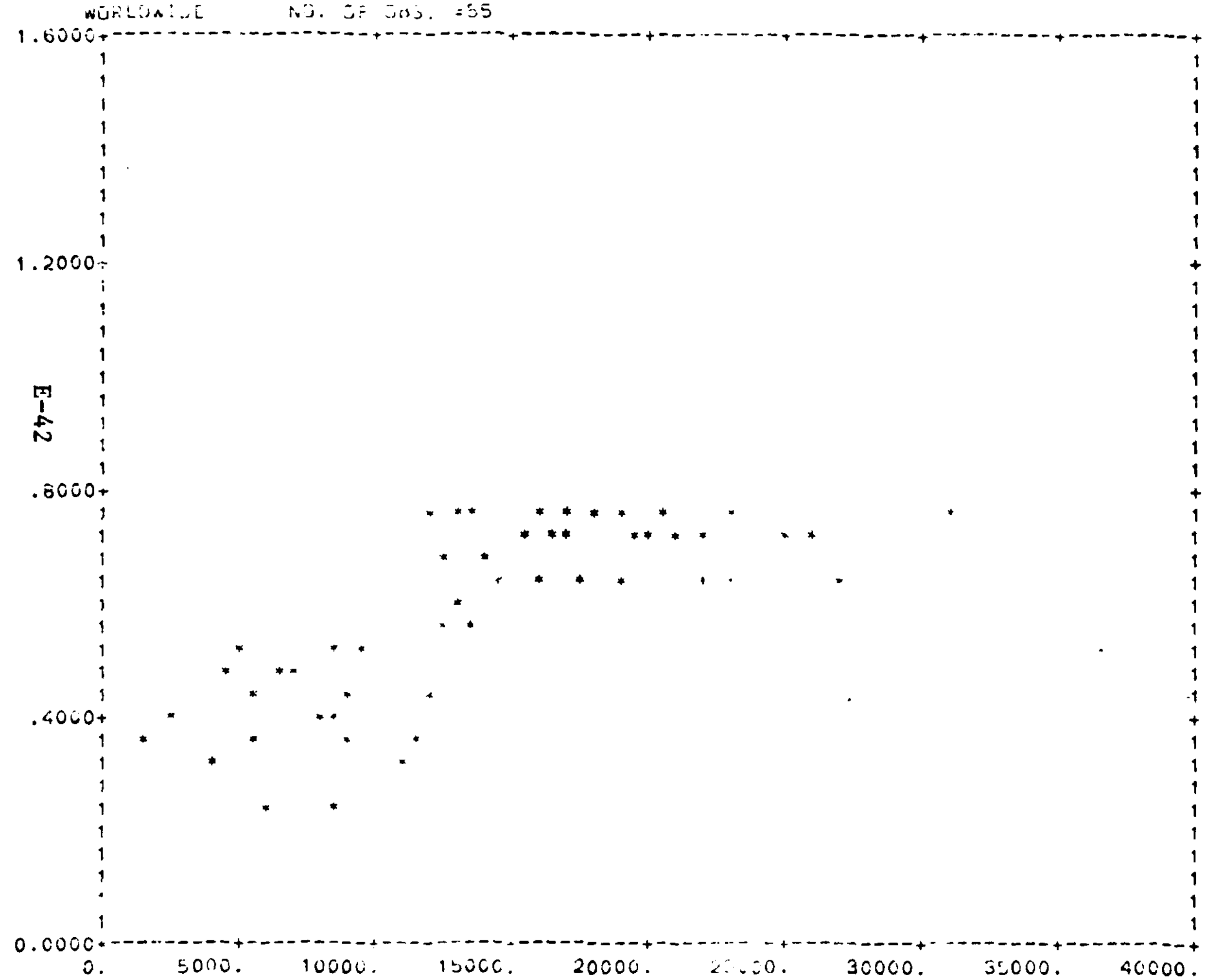
F-TEST= [illegible]616631043
R**2= [illegible] CORRELATION EST= [illegible]
S= .091[illegible]
SLOPE EST= [illegible] INTERCEPT EST= .6484 [illegible]26666

SYSTEM...

YVARIABLE= AVERAGE RELIABILITY

XVARIABLE= TOTAL FLYING HOURS

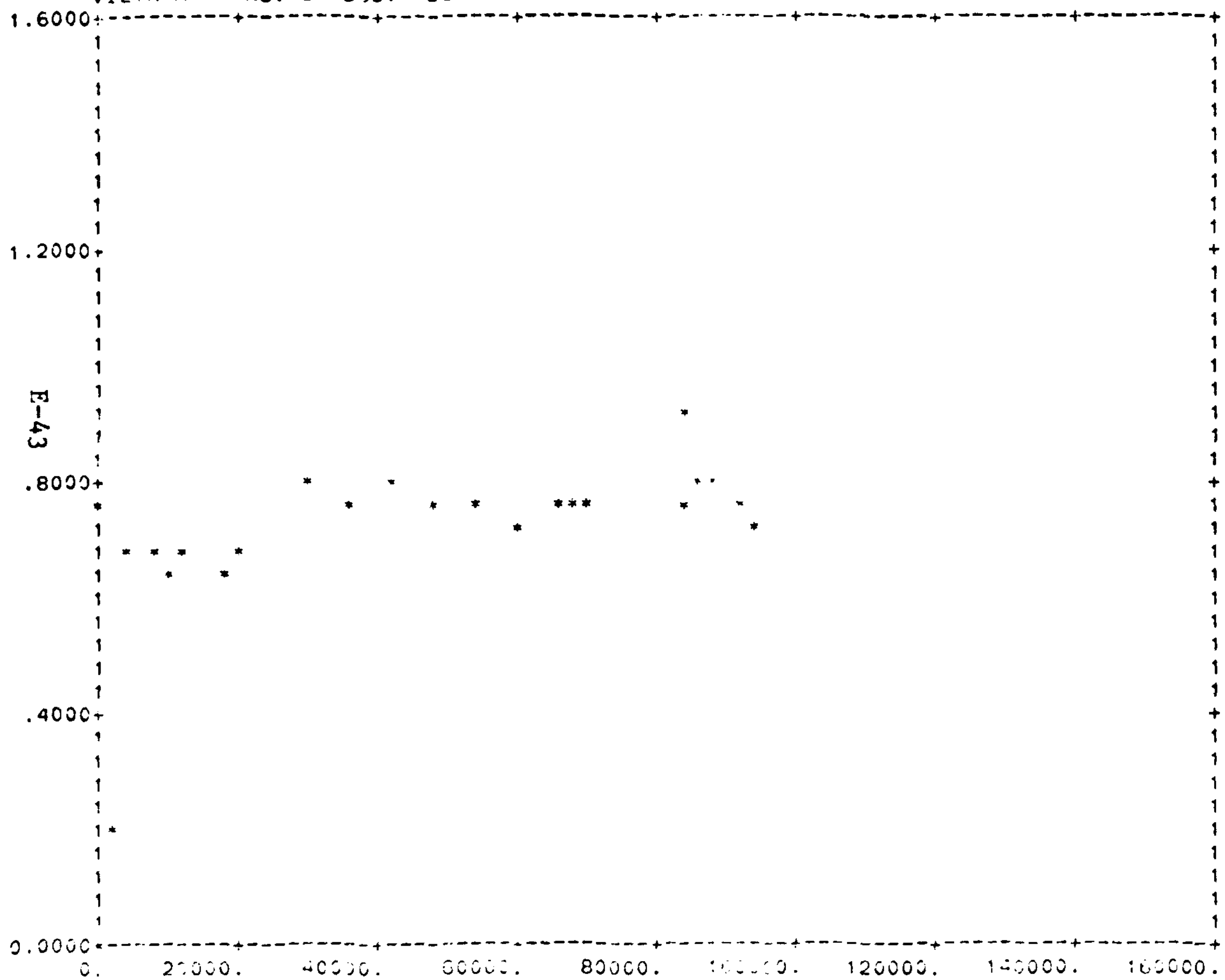
WORLDWIDE NO. OF OBS. =55



ANOVA TABLE

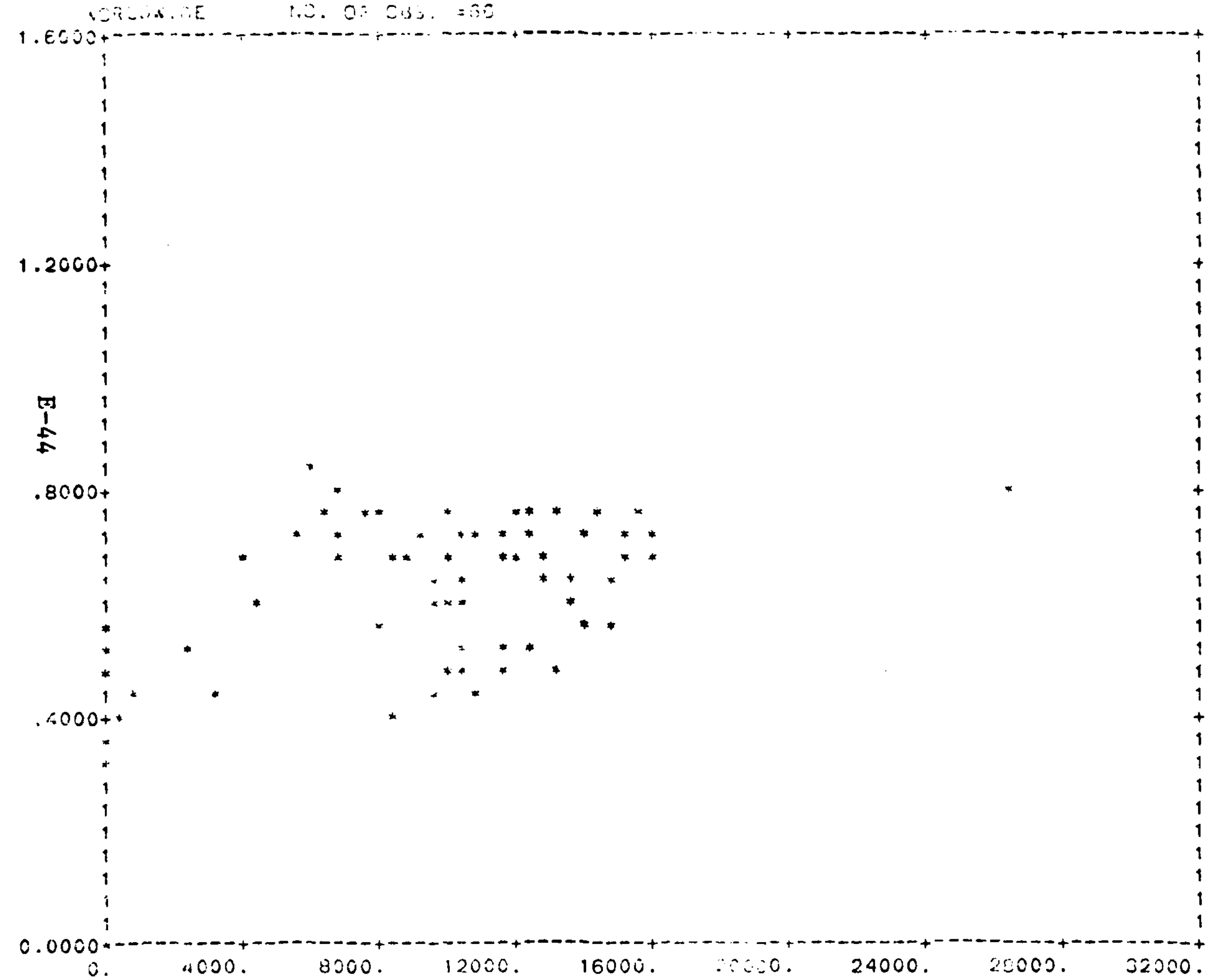
```
REGRESSION     DF=   1.    SS=  18.72633079407   MS=  18.72633079407
RESIDUAL       DF=  54.    SS=   1.724853205933  MS=   .03194172603579
TOTAL          DF=  55.    SS=  20.451184
F-TEST=   586.2654627081
R**2=   91.55599830145    S=   .1787224832966   CORR EST=   .7596658391052
B(1) EST=   .00003722004834527
```

SYSTEM=AH-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =23



ANOVA TABLE
REGRESSION DF= 1. SS= 9.149862760964 MS 9.149862760964
RESIDUAL DF= 22. SS= 3.200195239036 V = .145463410562
TOTAL DF= 23. SS= 12.350058
F-TEST= 62.90143372471
R**2= 74.08750963684 S= .381396570096 CORR COEF= .5180101697183
B(1) EST= .0000111053858401 9

SYSTEM=[illegible]
YVARIABLE= AVERAGE RELIA[illegible]ITY
XVARIABLE= TOTAL FLYING H[illegible]S
[illegible] NO. OF OBS. =[illegible]

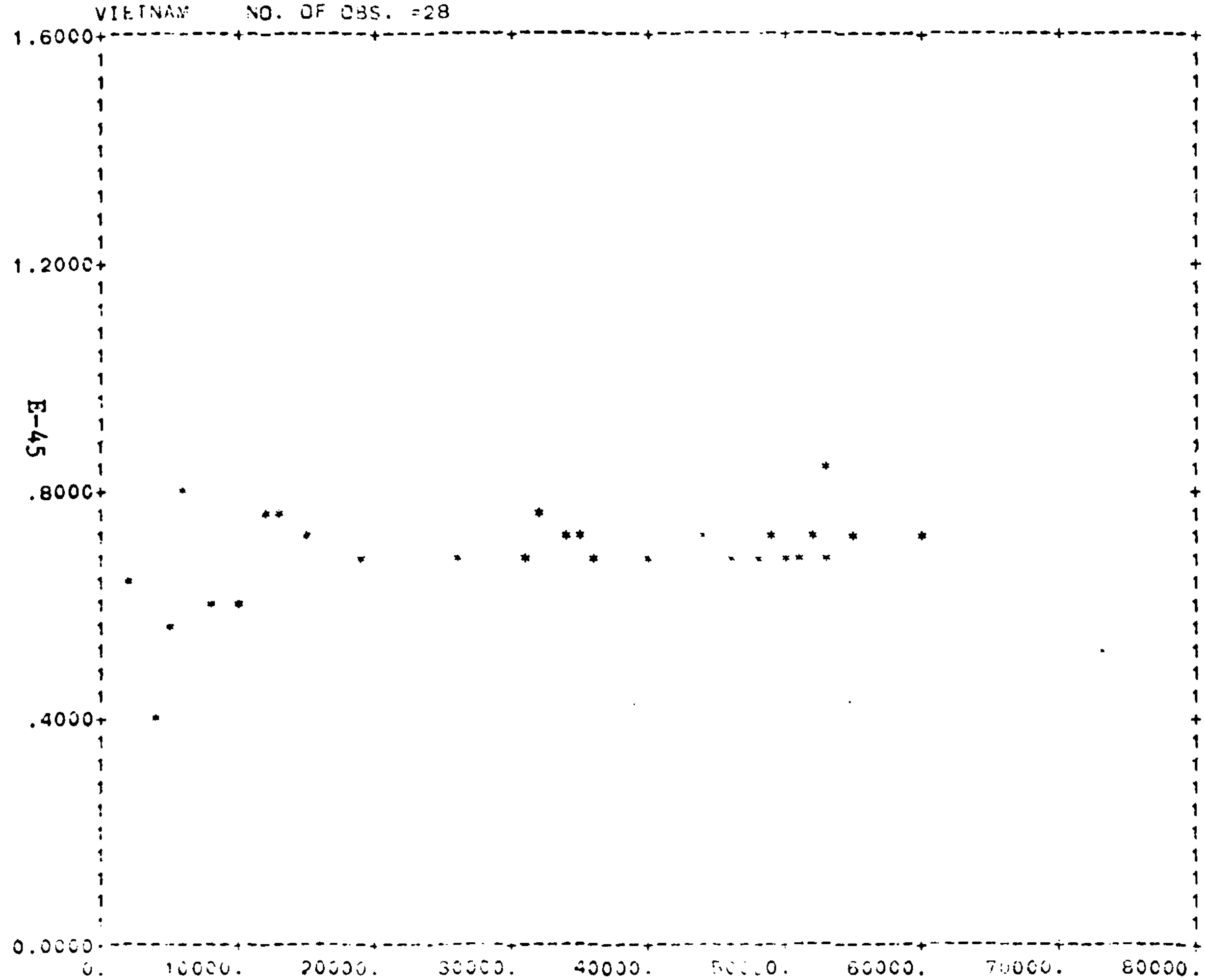


ANOVA TABLE

REGRESSION	DF=	1.	SS=	24.25010472067	MS=	24.25010472067
RESIDUAL	DF=	65.	SS=	3.417746279325	MS=	.05258071198962
TOTAL	DF=	66.	SS=	27.667851		

F-TEST= 461.1977244709
R**2= 87.64722898311 S= .2293048451072 CORR EST= .3665464355012
B(1) EST= .00005337734599572

```
SYSTEM=CH47
      YVARIABLE=                    AVERAGE RELIABILITY
      XVARIABLE=                    TOTAL FLYING HOURS
    VIETNAM     NO. OF OBS. =28
```

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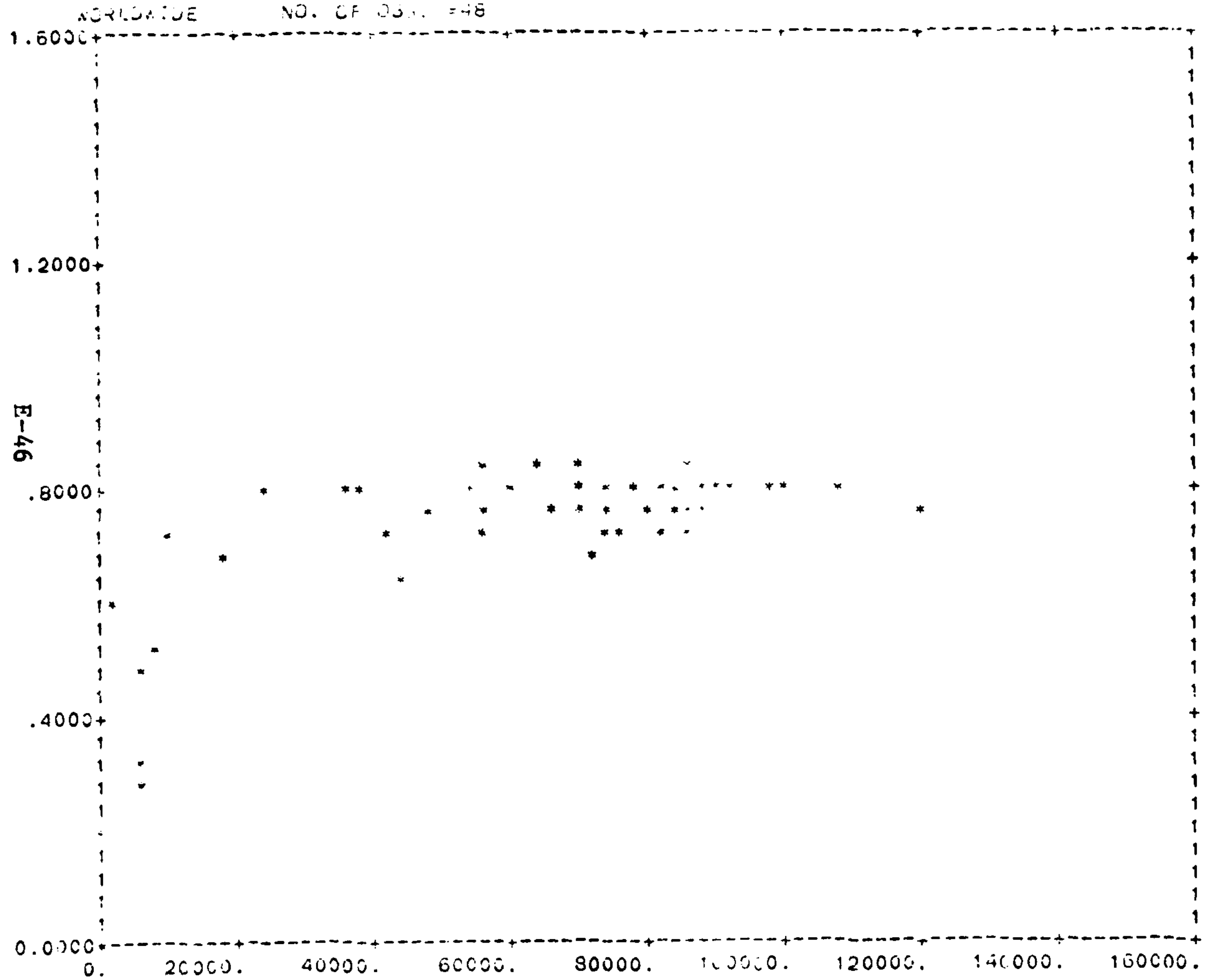
   ANOVA TABLE
REGRESSION     DF=   1.   SS=   [illegible].35107266403   MS=   [illegible].35107266403
RESIDUAL       DF=   2[illegible].   SS=   3.024[illegible]0533597   MS=   [illegible]11202.[illegible]272562
TOTAL          DF=   2[illegible].   SS=   1[illegible].3[illegible]5878
F-TEST=   [illegible]
R**2=   [illegible]   [illegible]   [illegible]347085706374   [illegible]   [illegible]   [illegible]393[illegible]682[illegible]
B(1) EST=   [illegible]
```

SYSTEM=[illegible]
YVARIABLE= AVERAGE [illegible]
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =48



ANOVA TABLE

REGRESSION	DF=	1.	SS=	22.83335909156	MS=	22.83335909156
RESIDUAL	DF=	47.	SS=	3.177978908437	MS=	.06761657251993
TOTAL	DF=	48.	SS=	26.011338		

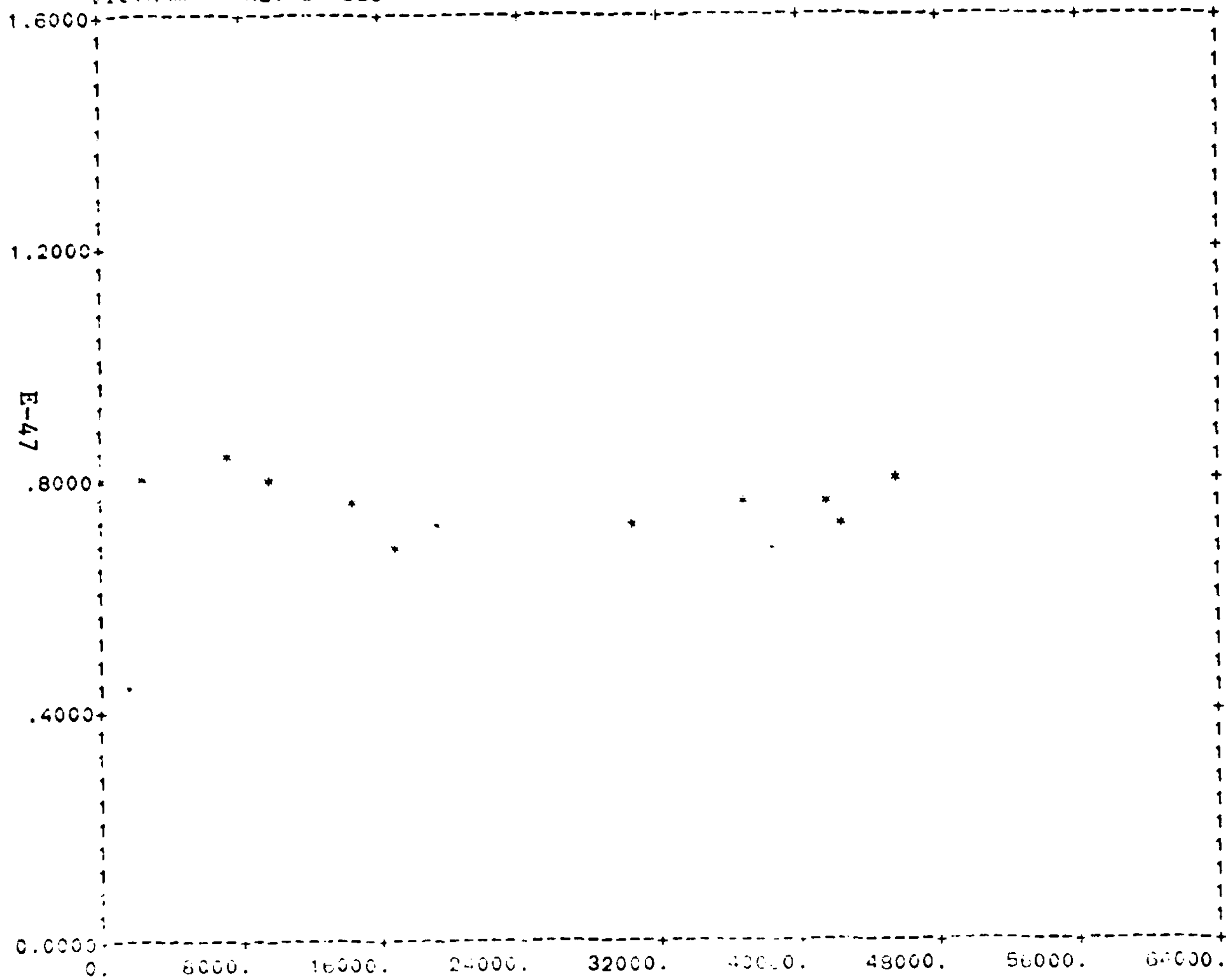
F-TEST= 337.6637/97888
R**2= 87.78233204137 S= .2600318682776 CORR EST= .6914319250881
B(1) EST= .00001012811218994

SYSTEM=OH58

YVARIABLE= AVERAGE RELIABILITY

XVARIABLE= TOTAL FLYING HOURS

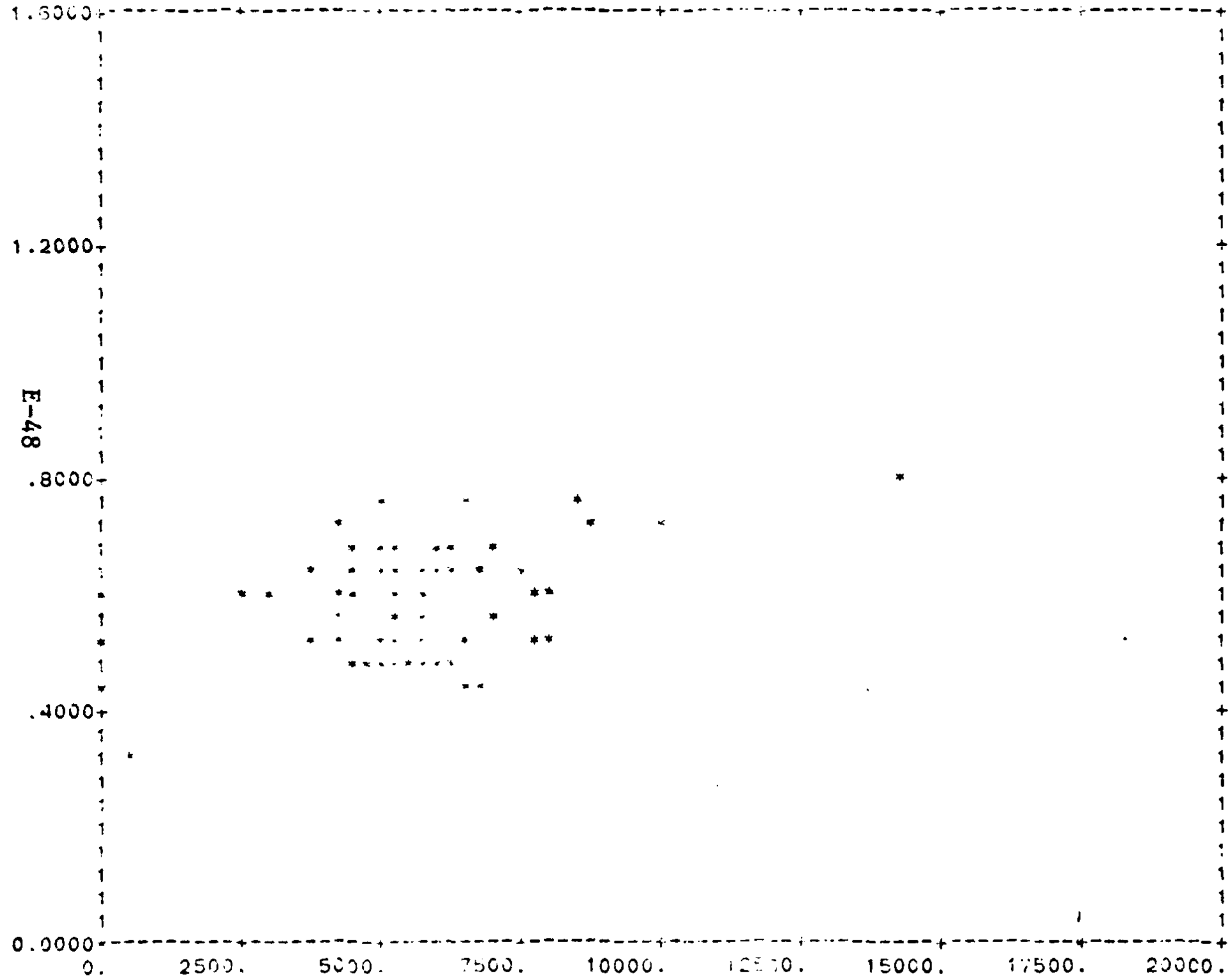
VIETNAM NO. OF OBS. =14



ANOVA TABLE

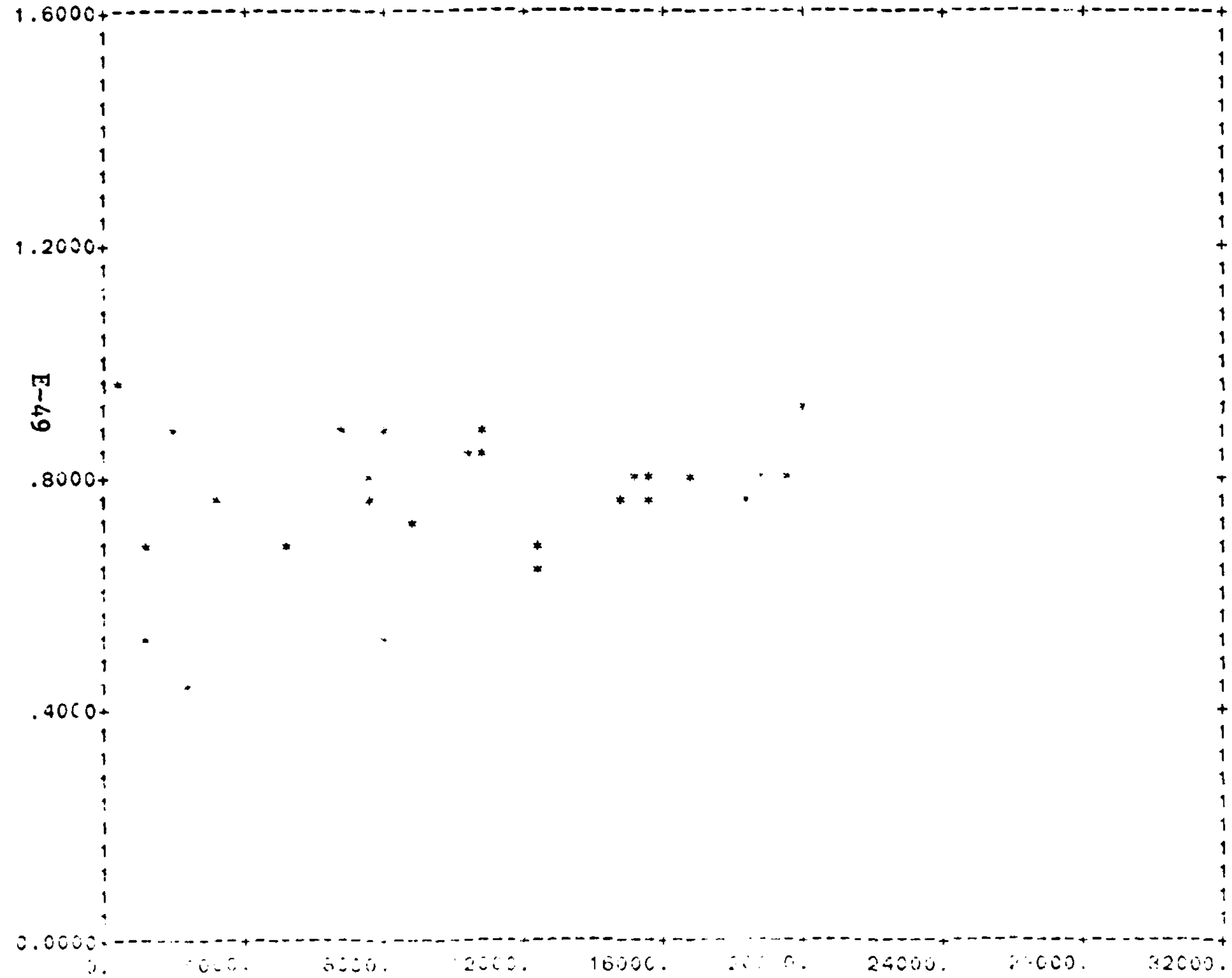
```
REGRESSION   DF=  1.   SS=  [illegible]5578402   MS=  [illegible].987625578402
RESIDUAL     DF= [illegible]  SS=  [illegible]351421509   MS=  .202[illegible]54033891
TOTAL        DF= 14.   SS=  [illegible]277
F-TEST=   2[illegible]
R**2=  [illegible]   SE=  [illegible]38446330  CCF [illegible]  [illegible]32926442[illegible]
B(1) EST=  .0000[illegible]
```

SYSTEM=C-[illegible]
YVARIABLE= AVERAGE [illegible]
XVARIABLE= TOTAL FLYING [illegible]S
[illegible] NO. OF OBS. 65



```
ANOVA TABLE
REGRESSION    DF=   1.   SS=  20.7609503428[illegible]   MS=  20.7609503428[illegible]
RESIDUAL      DF=  64.   SS=   1.822207657124   MS=   .02847199464256
TOTAL         DF=  65.   SS=  22.583158
F-TEST=   729.170[illegible]5063
R**2=   91.93113116063     S=   .1687364650643   CORR EST=   .3830365504256
B(1) EST=    .0000943101945[illegible]
```

SYSTEM=OV-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =29



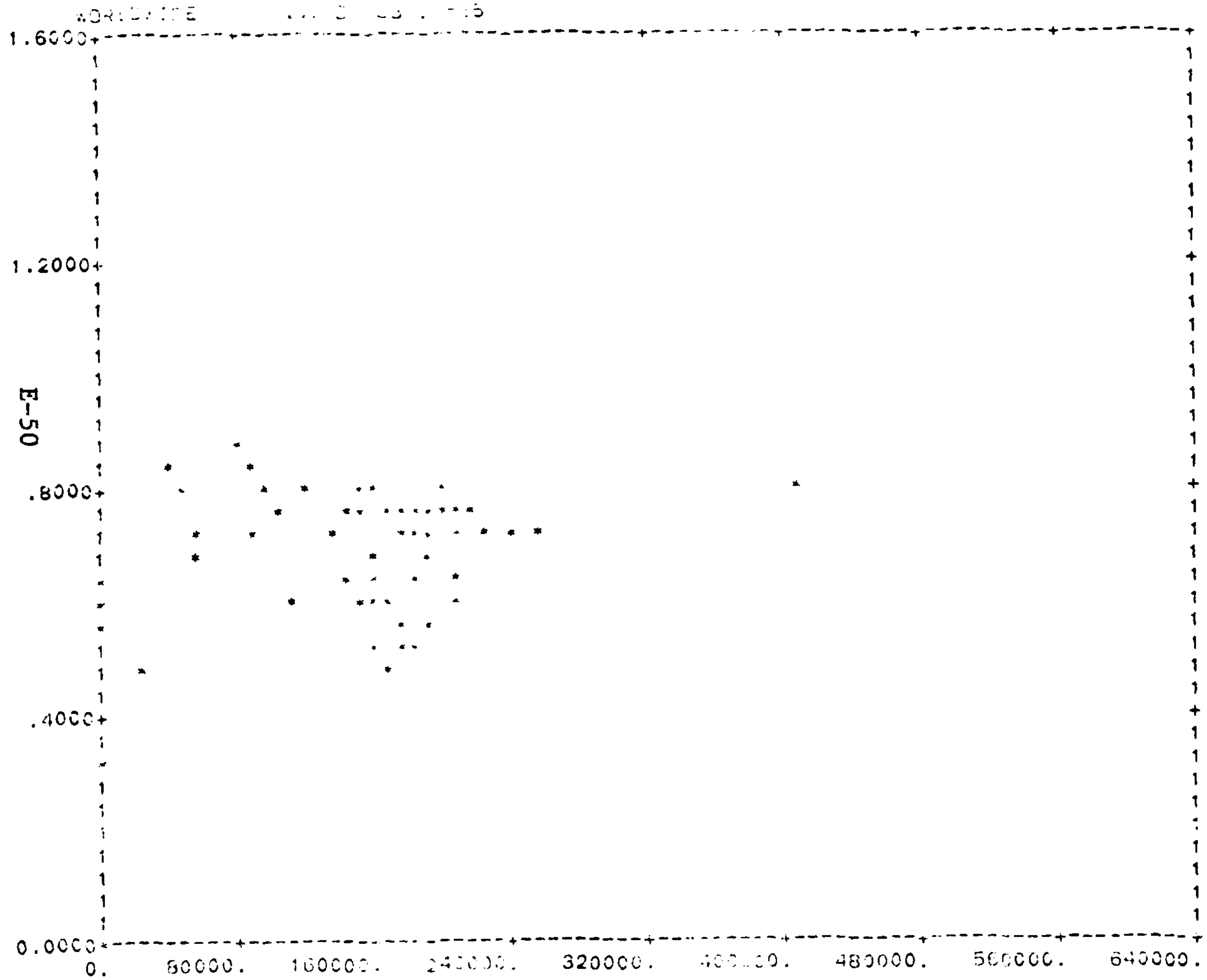
ANOVA TABLE

REGRESSION DF= 1. SS= [illegible]1161324 MS= [illegible]161324
RESIDUAL DF= 28. SS= 4.[illegible]00386762 MS= .14[illegible]5013612[illegible]
TOTAL DF= 2[illegible]. SS= [illegible]2112
F-TEST= [illegible]
R**2= [illegible] [illegible]03955[illegible] [illegible]
B(1) EST= [illegible]

SYSTEM

VARIABLE= AVERAGE

XVARIABLE= TOTAL FLYING



ANOVA TABLE

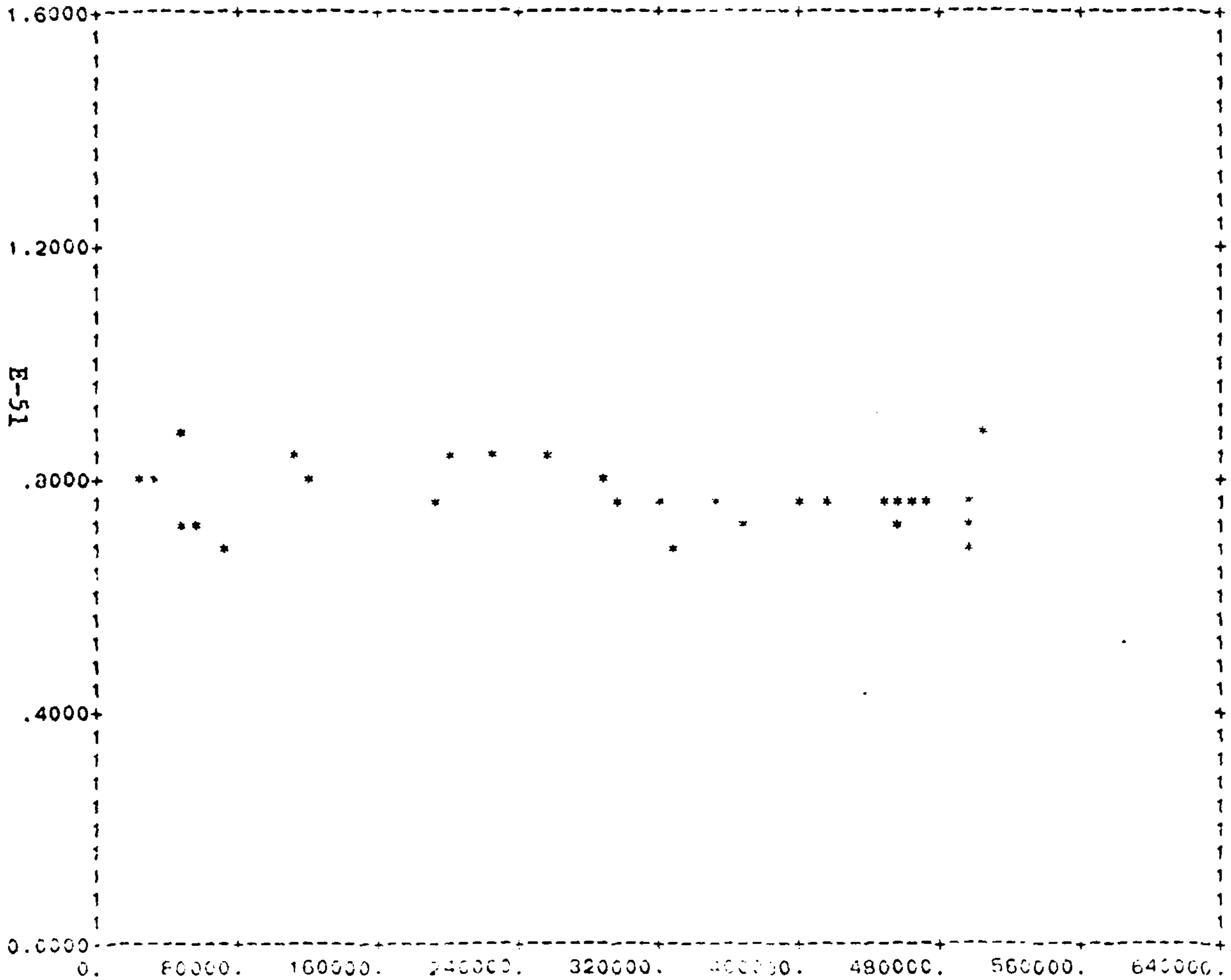
REGRESSION	DF= 1.	SS= 28.47843043339	MS=	[illegible].47843048339
RESIDUAL	DF= 64.	SS= 4.18569351661	MS=	.06540146119703
TOTAL	DF= 65.	SS= 32.664124		

F-TEST= 435.4432786633

R**2= 87.12565507341 S= .2557370933012 CORR EST= .0019336907\2054

B(1) EST= .00000374004934C912

SYSTEM=UH-1
YVARIABLE= AVERAGE RELIABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =30

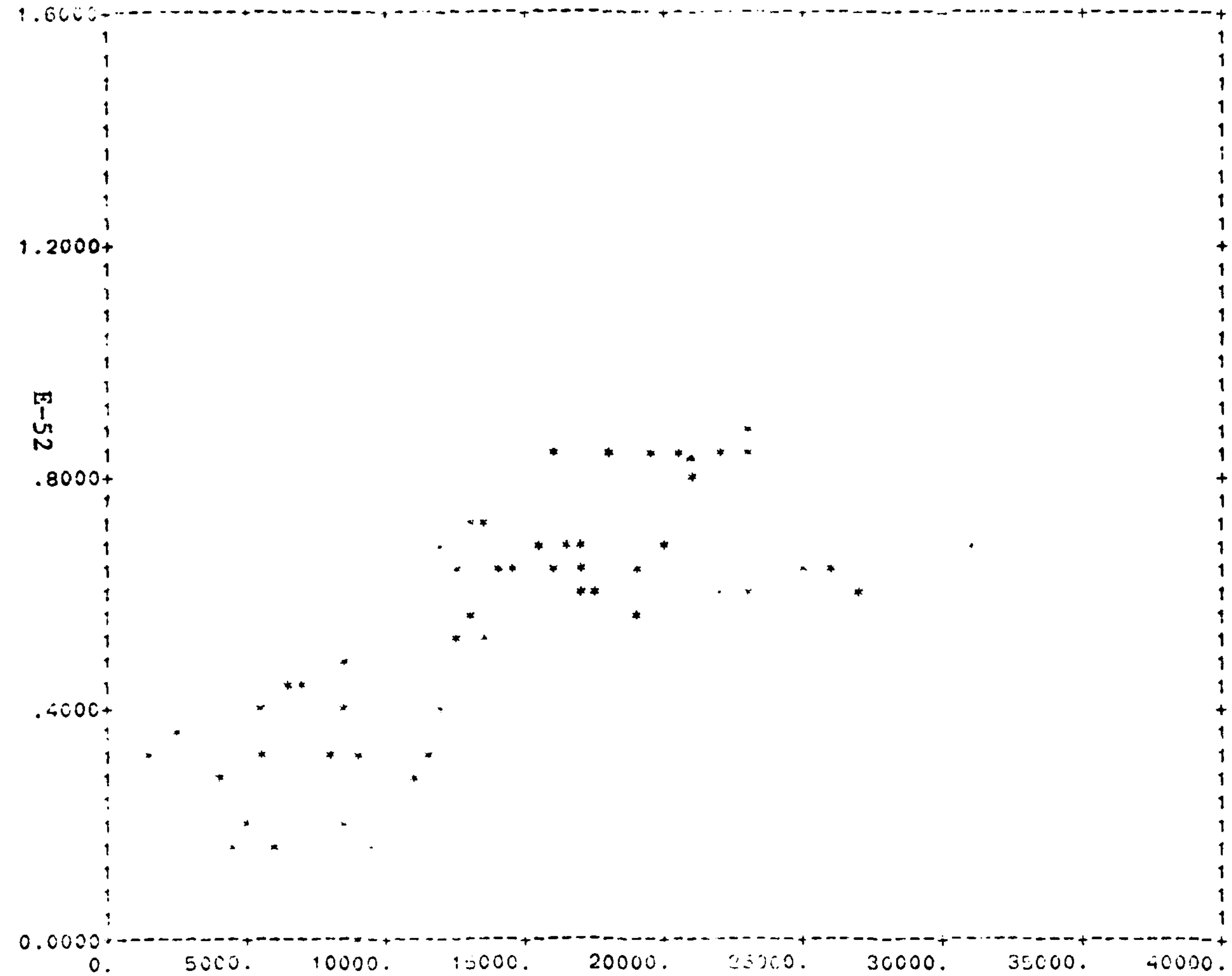


ANOVA TABLE

REGRESSION	DF=	1.	SS=	13.18035892836	MS=	13.18035892886
RESIDUAL	DF=	29.	SS=	4.523972071141	MS=	.155990036935
TOTAL	DF=	30.	SS=	17.704331		

F-TEST= [illegible]
R**2= [illegible] [illegible] .5946071339940 [illegible] -.2572702[illegible]
B(1) EST= [illegible]

SYSTEM A--1
Y VARIABLE= AVERAGE AVAILABILITY
X VARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF CASES=54



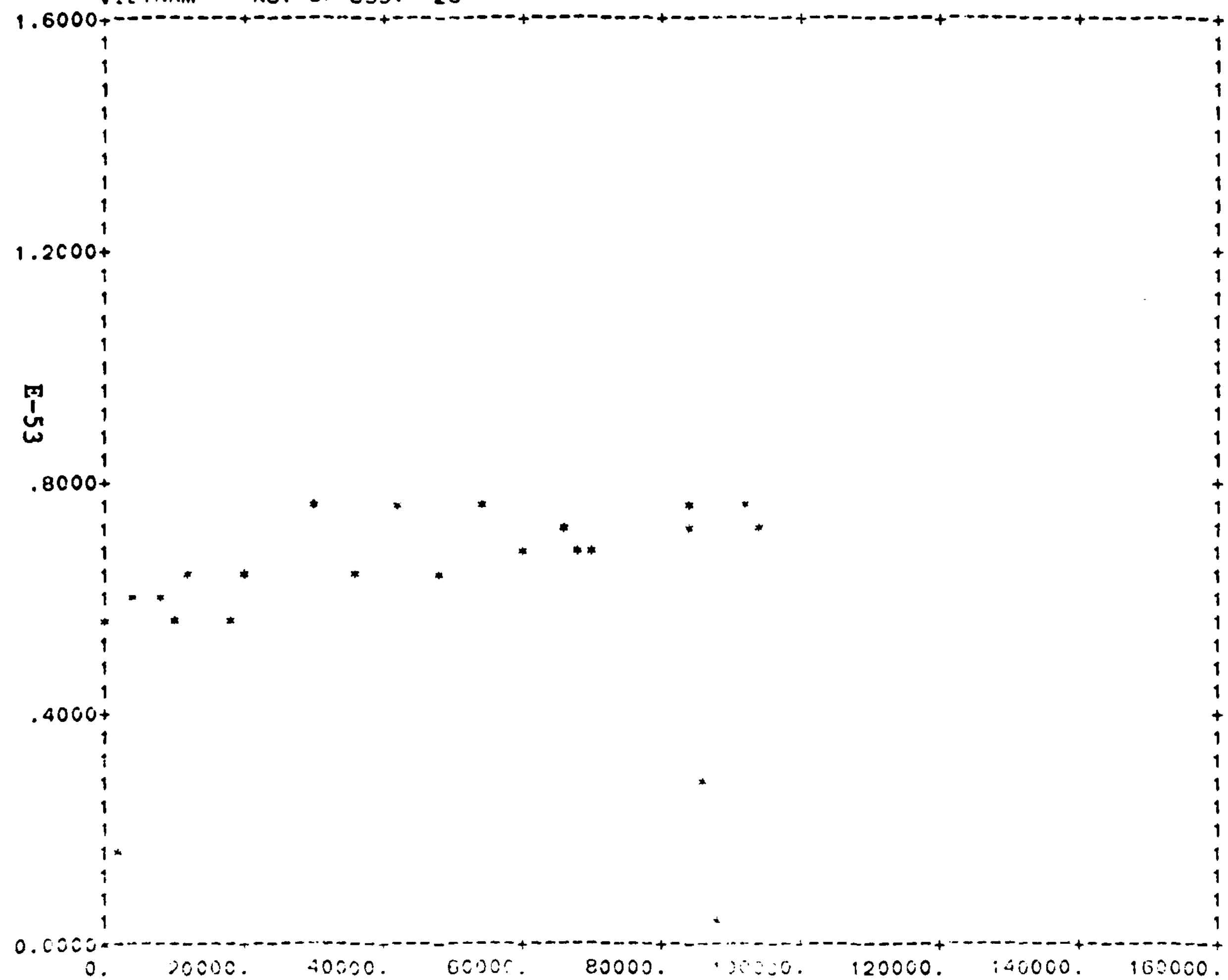
E-52

ANOVA TABLE

REGRESSION	DF=	1.	SS=	16.81737736367	MS=	16.81737736367
RESIDUAL	DF=	53.	SS=	1.439458636328	MS=	.02715959691183
TOTAL	DF=	51.	SS=	18.256836		

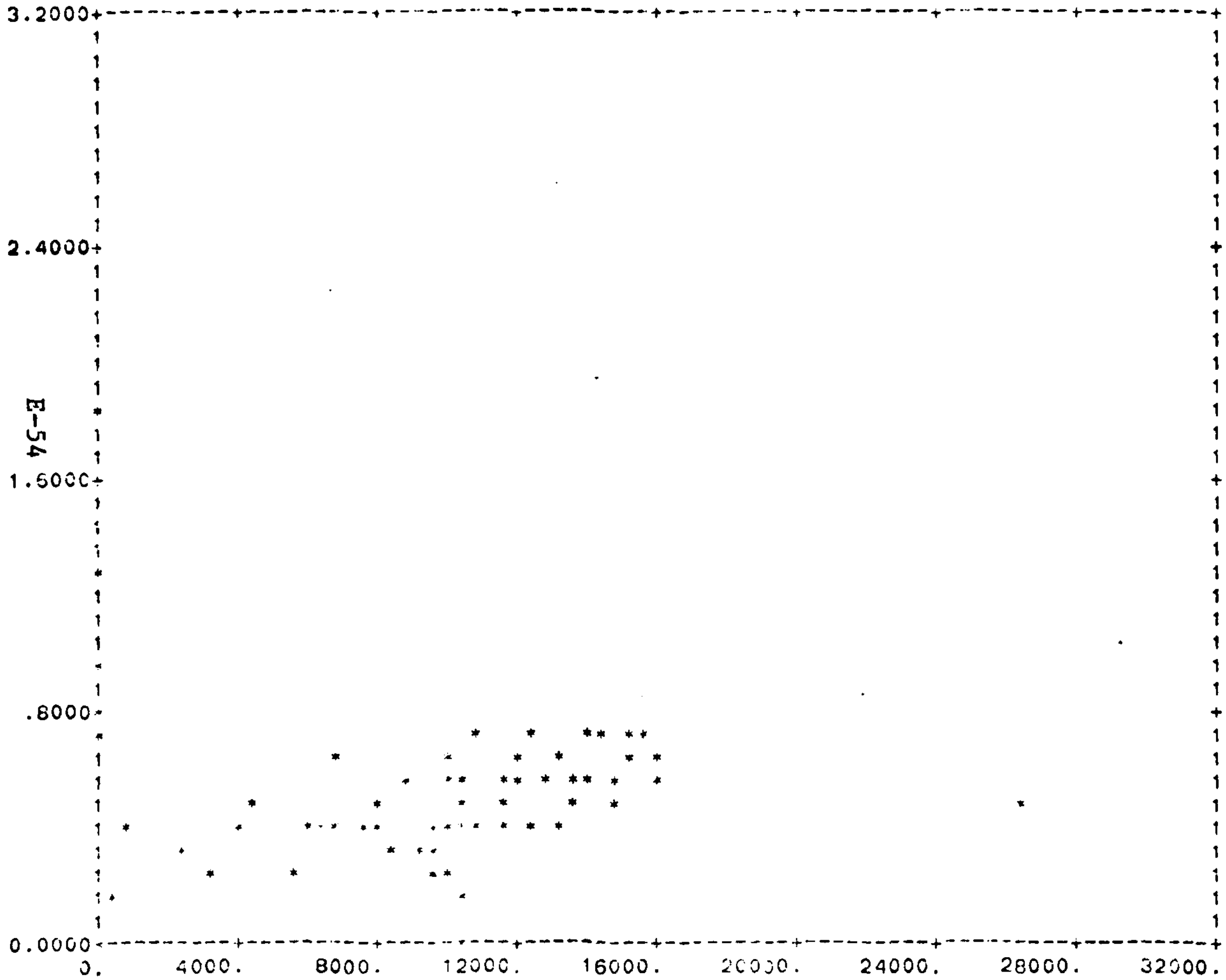
F-TEST= 619.205705381
R**2= 92.11550875339 S= .164801689651 CORR EST= .7554270069835
B(1) EST= .0000353800732587

```
SYSTEM=AH-1
     YVARIABLE=                    AVERAGE AVAILABILITY
     XVARIABLE=                    TOTAL FLYING HOURS
    VIETNAM     NO. OF OBS. =23
```




```
   ANOVA TABLE
REGRESSION    DF=   1.   SS=   5.841969544619   MS=   5.841969544619
RESIDUAL      DF=  22.   SS=   3.347502455381   MS=   .152102838800
TOTAL         DF=  23.   SS=   9.189352
F-TEST=   38.39287954137
R**2=   63.57188448935     S=   .3900305543486  CORR EST=   .07611851517178
B(1) EST=   .00000887372424016B
```

SYSTEM=CH47
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =65



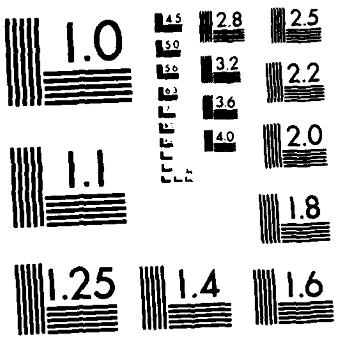
ANOVA TABLE

REGRESSION	DF= 1.	SS= 15.18615290735	MS= 15.18615290735
RESIDUAL	DF= 64.	SS= 2.211345092647	MS= .03455226707261
TOTAL	DF= 65.	SS= 17.397498	

F-TEST= 439.5124891643
R**2= 87.28929244511 S= .1858824011912 CORR EST= .4412046613905
B(1) EST= .00004251304165923

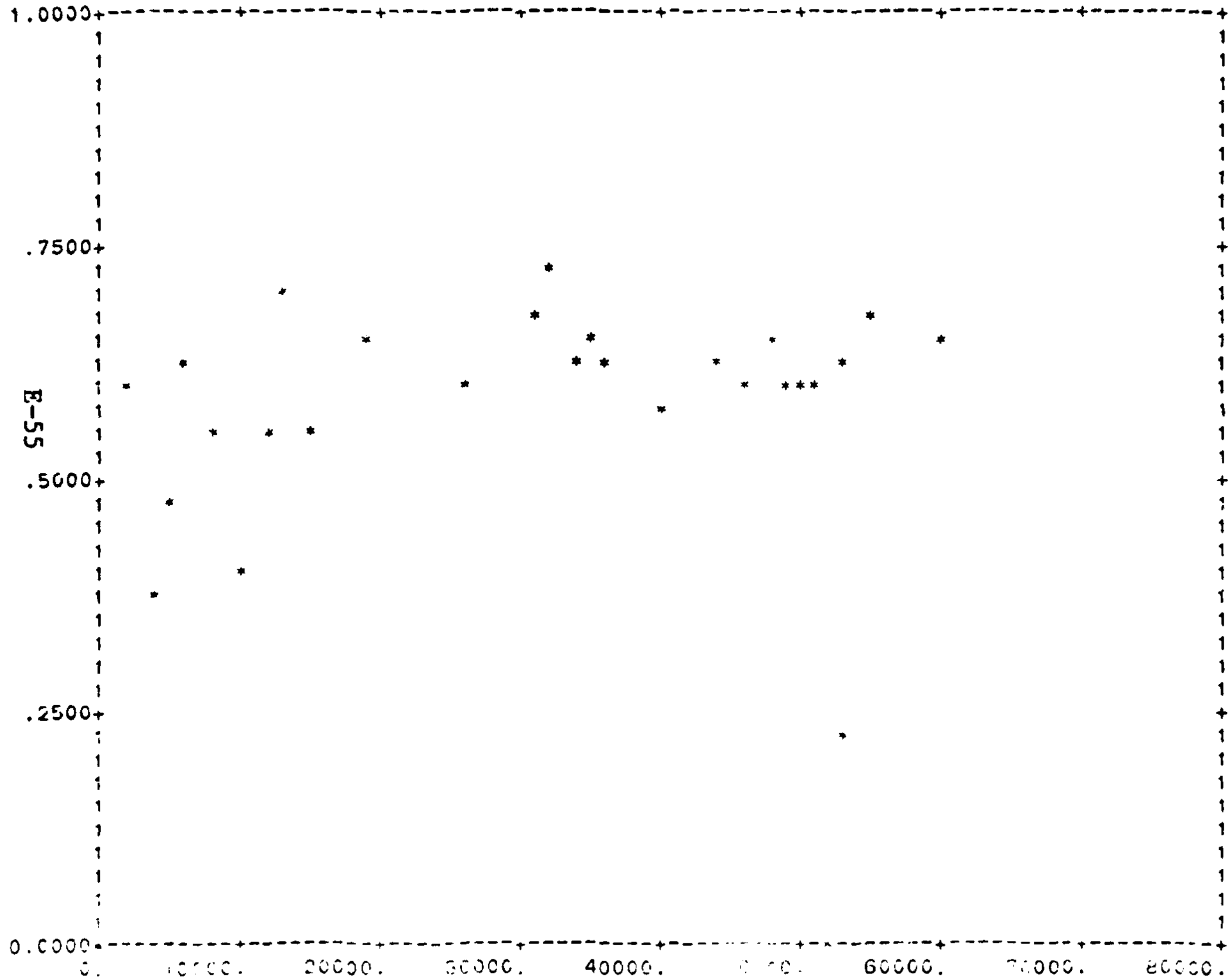
AD-A134 745 SORTIE DURATION AND HELICOPTER COMPONENT FAILURES (AN EMPIRICAL STUDY)(U) ARMY INVENTORY RESEARCH OFFICE PHILADELPHIA PA E GOTWALS MAY 83 USAIRO-TR-83/3 3/3

UNCLASSIFIED F/G 1/3 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

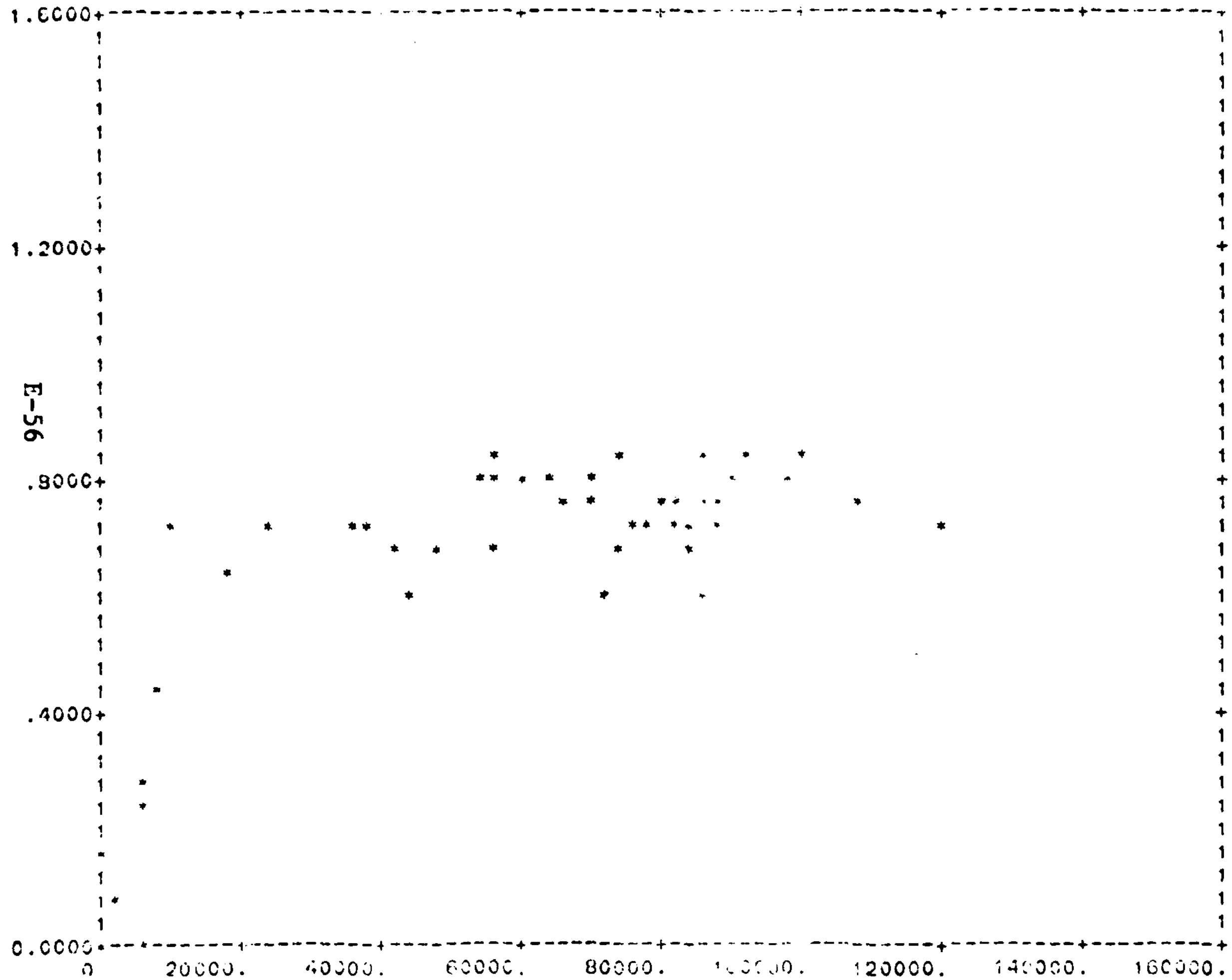
SYSTEM=CH47
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =28



ANOVA TABLE

REGRESSION DF= 1. SS= 0.031875619349 MS= 0.031875619349
RESIDUAL DF= 27. SS= 2.40596738065 MS= 0.0891022463
TOTAL DF= 28. SS= 9.557323
F-TEST= [illegible]24105
R**2= [illegible] S= .0231947178257 [illegible] -.1057120.3553877
B(1) EST= .000013254543[illegible]

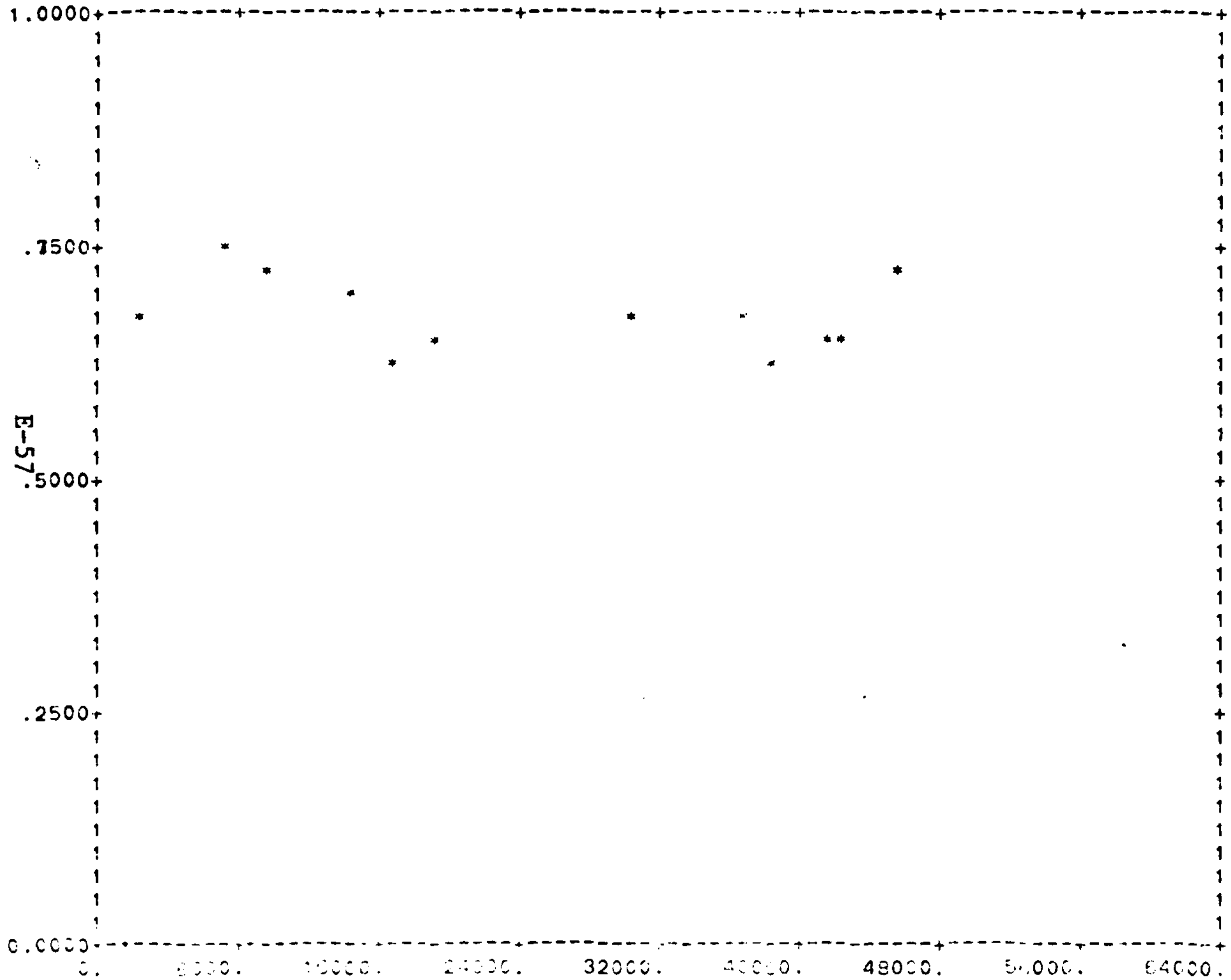
SYSTEM C ...
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. 47



ANOVA TABLE

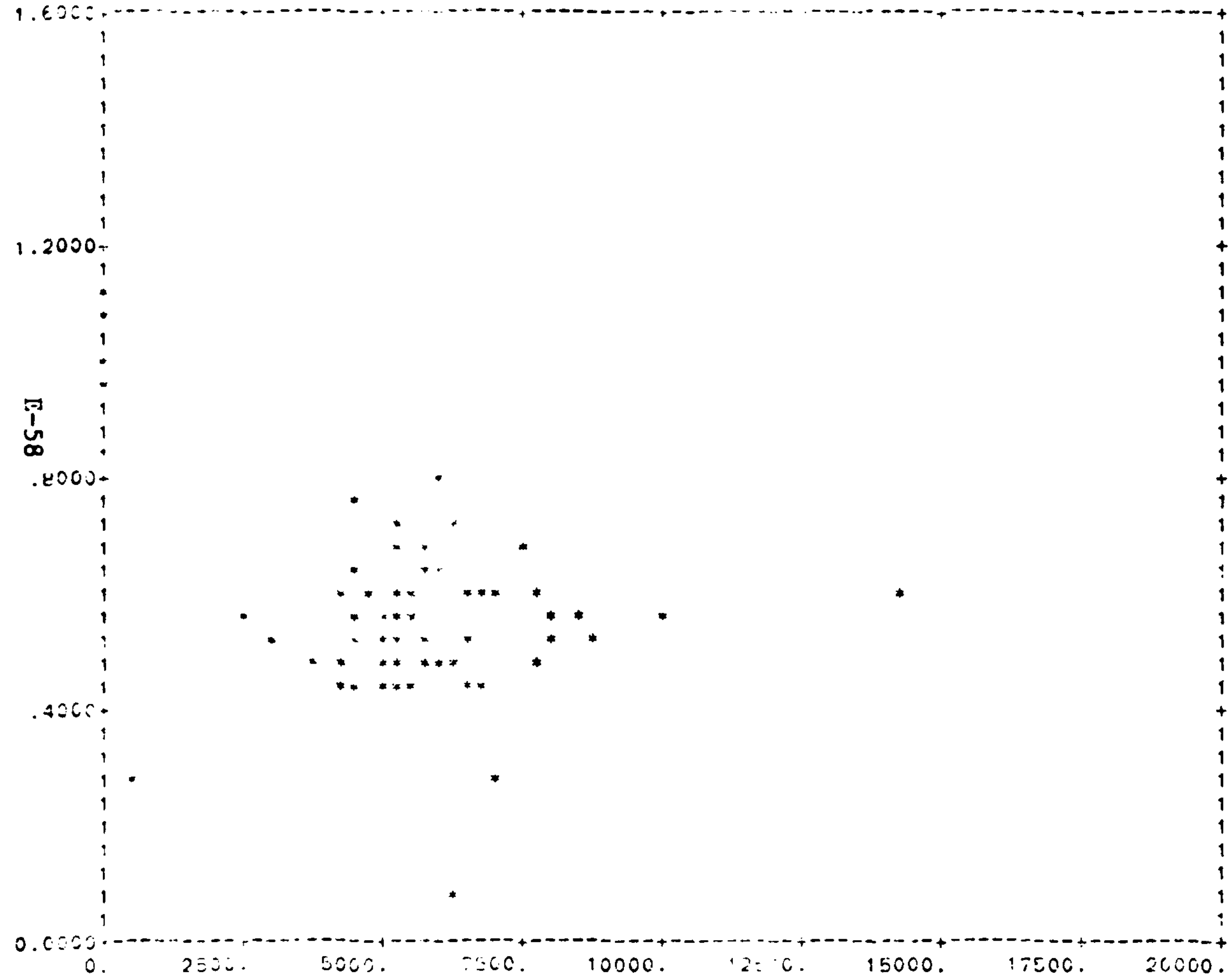
REGRESSION DF= 1. SS= 21.18481062147 MS= 21.18481062147
RESIDUAL DF= 46. SS= 2.41542337853 MS= .05250920388108
TOTAL DF= 47. SS= 23.600234
F-TEST= 403.4484727715
R**2= 89.7652566558 S= .2291458683827 CORR EST= .6915324177336
B(1) EST= .00000975408839657

SYSTEM=OH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =12



ANOVA TABLE
REGRESSION DF= 1. SS= 4.05856533291 MS= 4.05856533291
RESIDUAL DF= 11. SS= [illegible]39266709 MS= [illegible]37120060991
TOTAL DF= 12. SS= [illegible]58
F-TEST= 29.[illegible]
R**2= [illegible] [illegible]60978422 COR[illegible] = [illegible]475[illegible]
STD EST= [illegible]

SYSTEM [illegible]
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
NO. OF OBS 66

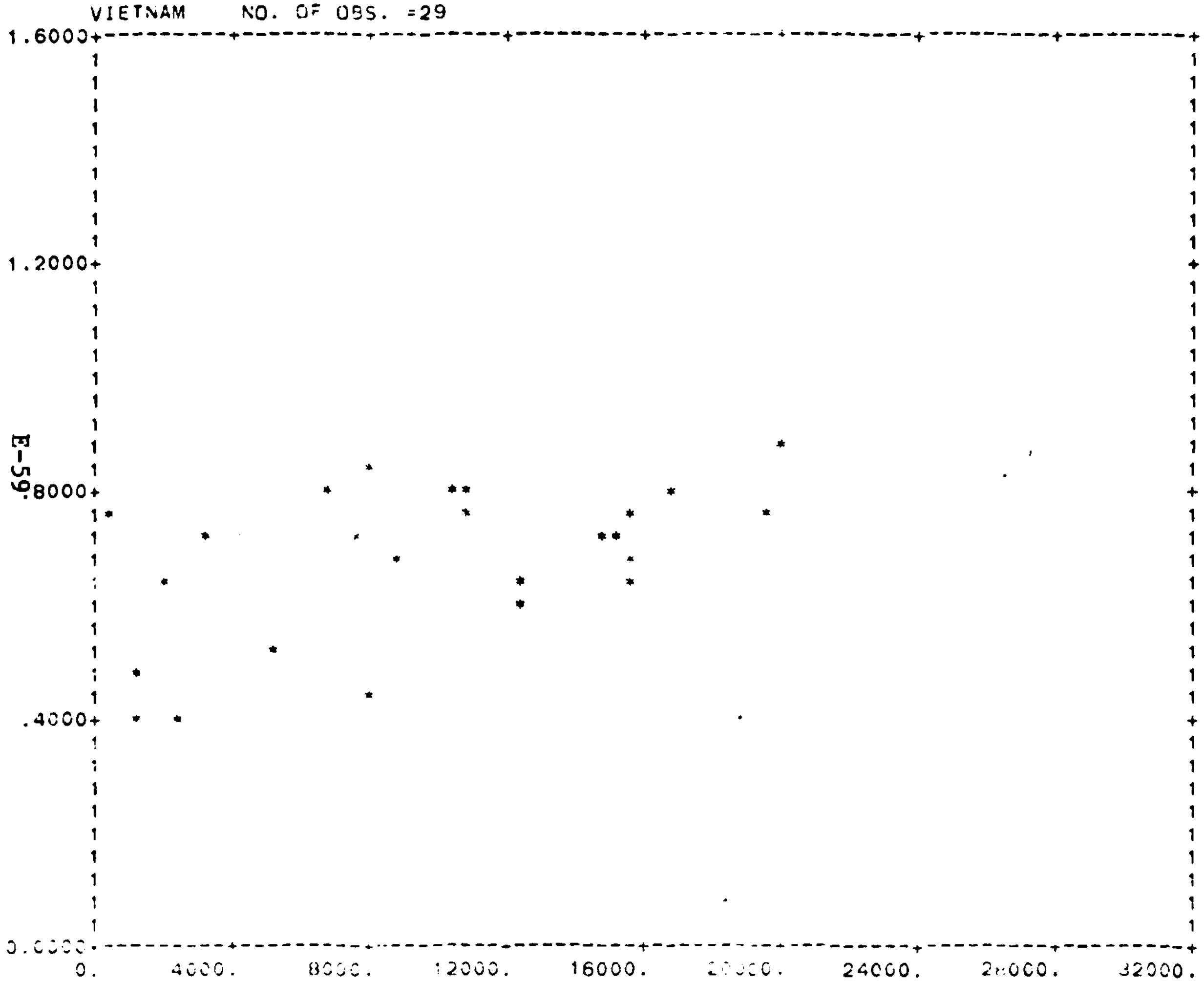


ANOVA TABLE

REGRESSION	DF=	1.	SS=	17.42079909556	MS=	17.42079909556
RESIDUAL	DF=	64.	SS=	2.309326904442	MS=	.03608323288[illegible]
TOTAL	DF=	65.	SS=	19.730126		

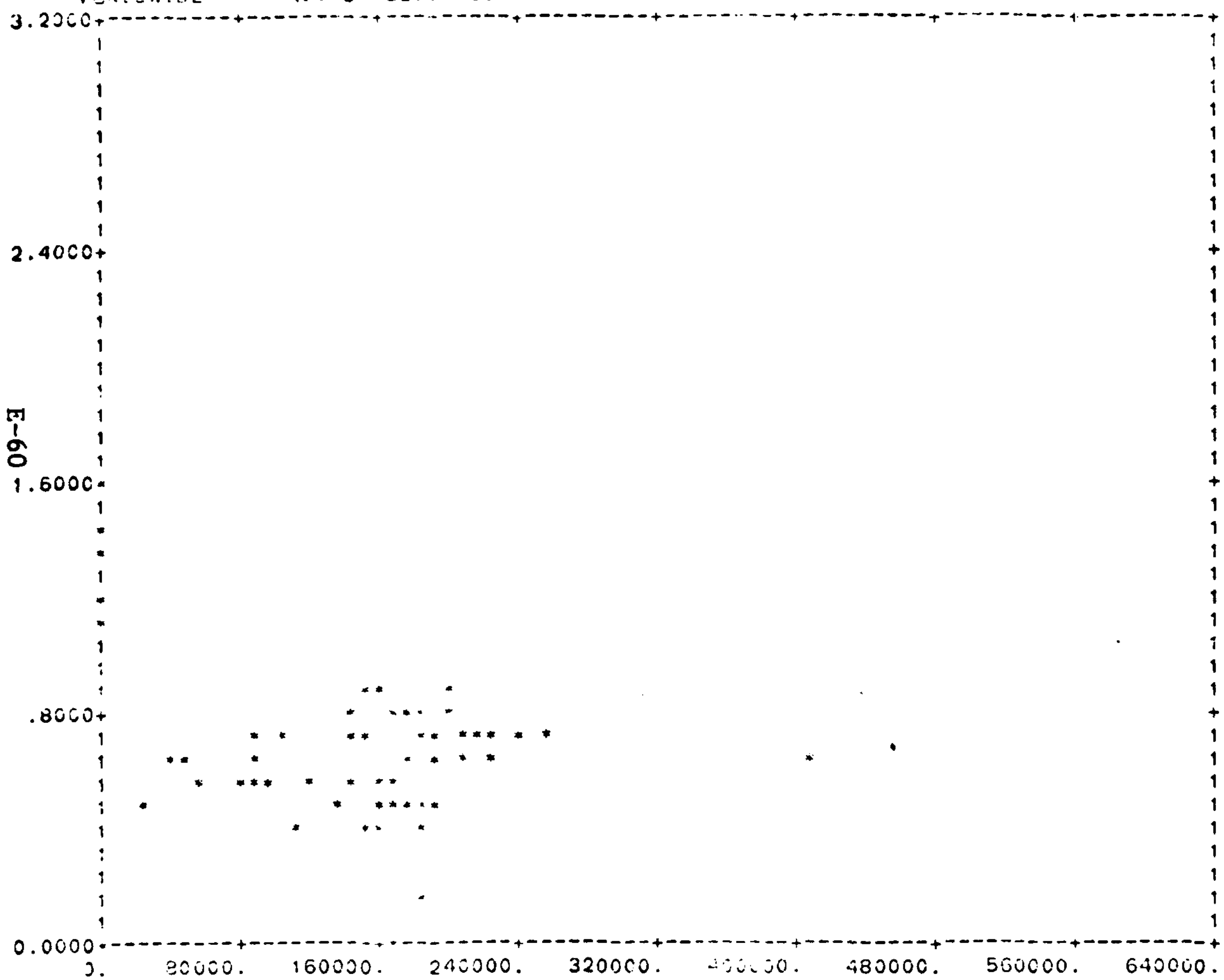
F-TEST= 482.7942524617
R**2= 88.29542748763 S= .1899558708803 COEF EST= .1557998[illegible]803
B(1) EST= .0000860911115[illegible]47

SYSTEM=OV-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =29



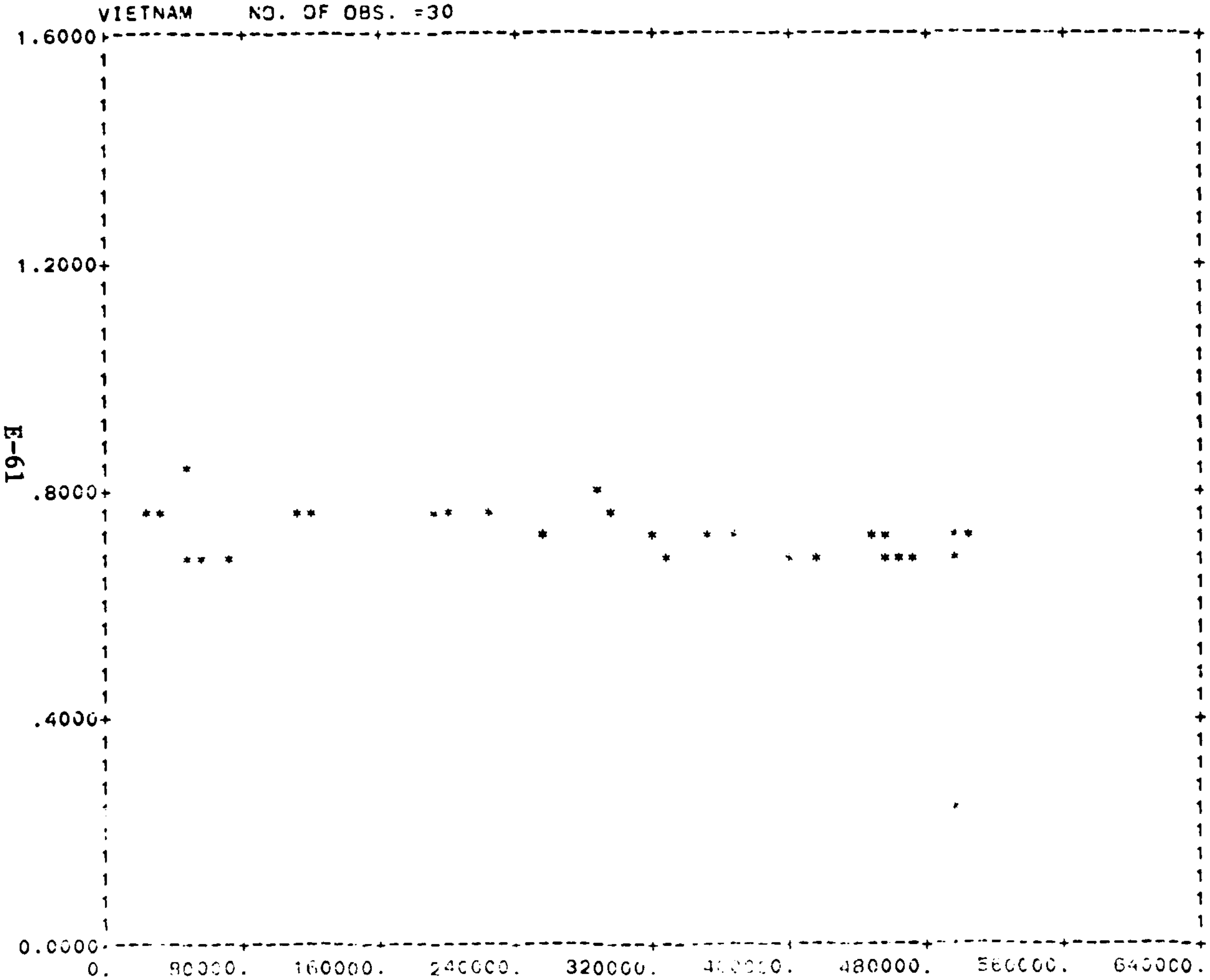
ANOVA TABLE
REGRESSION DF= 1. SS= 9.651718623655 MS= 9.651718623655
RESIDUAL DF= 26. SS= MS=
TOTAL DF= SS=
F-TEST=
R**2=
B(1) EST=

```
SYSTEM...
     YVARIABLE=                    AVERAGE AVAIL...
     XVARIABLE=                    TOTAL FLYING HOURS
   HORIZONTAL      NO. OF OBS. 66
```



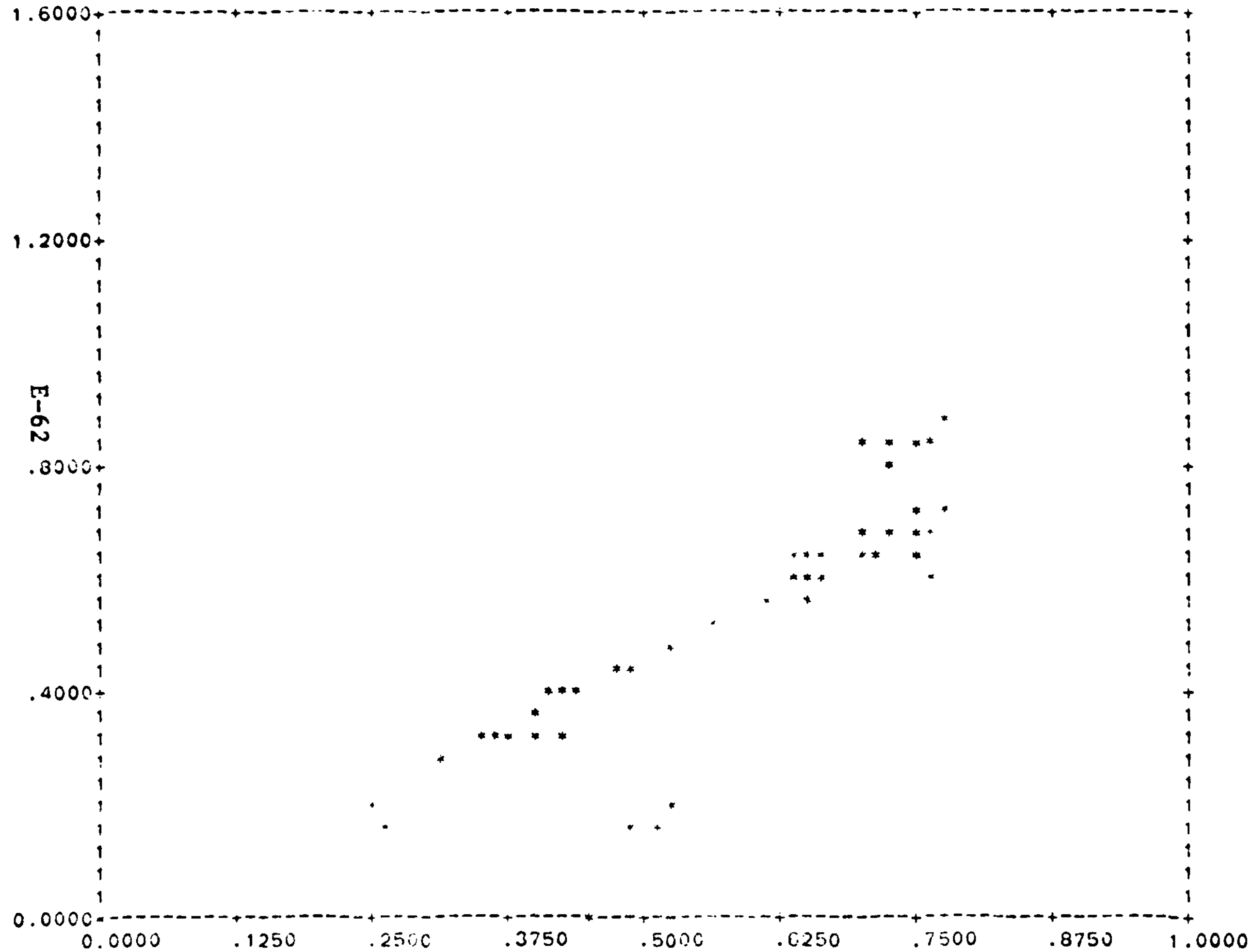
```
    ANOVA TABLE
REGRESSION    DF=   1.   SS=   23.1348475156   MS=   23.1348475156
RESIDUAL      DF=  64.   SS=   3.601185484404   MS=   .05626852319381
TOTAL         DF=  65.   SS=   26.736033
F-TEST=   411.1507858584
R**2=   86.53059156381     S=   .2372098716197   CORR EST=   .2166192269487
B(1) EST=   .00000337095299546
```

SYSTEM=UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =30



ANOVA TABLE
REGRESSION DF= 1. SS= 9.456405438904 MS= [illegible].456495433904
RESIDUAL DF= 2[illegible]. SS= [illegible]01326601046 MS= [illegible]17[illegible]78124519
TOTAL DF= 30. SS= 14.557822
F-TEST= 53.[illegible]04580797
R**2= 64.[illegible] S= [illegible]4136531535 CORR [illegible] -.4146992[illegible]
B(1) EST= .0000013409893211 92

SYSTEM=[illegible]
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
WORLDWIDE NO. OF OBS. [illegible]54

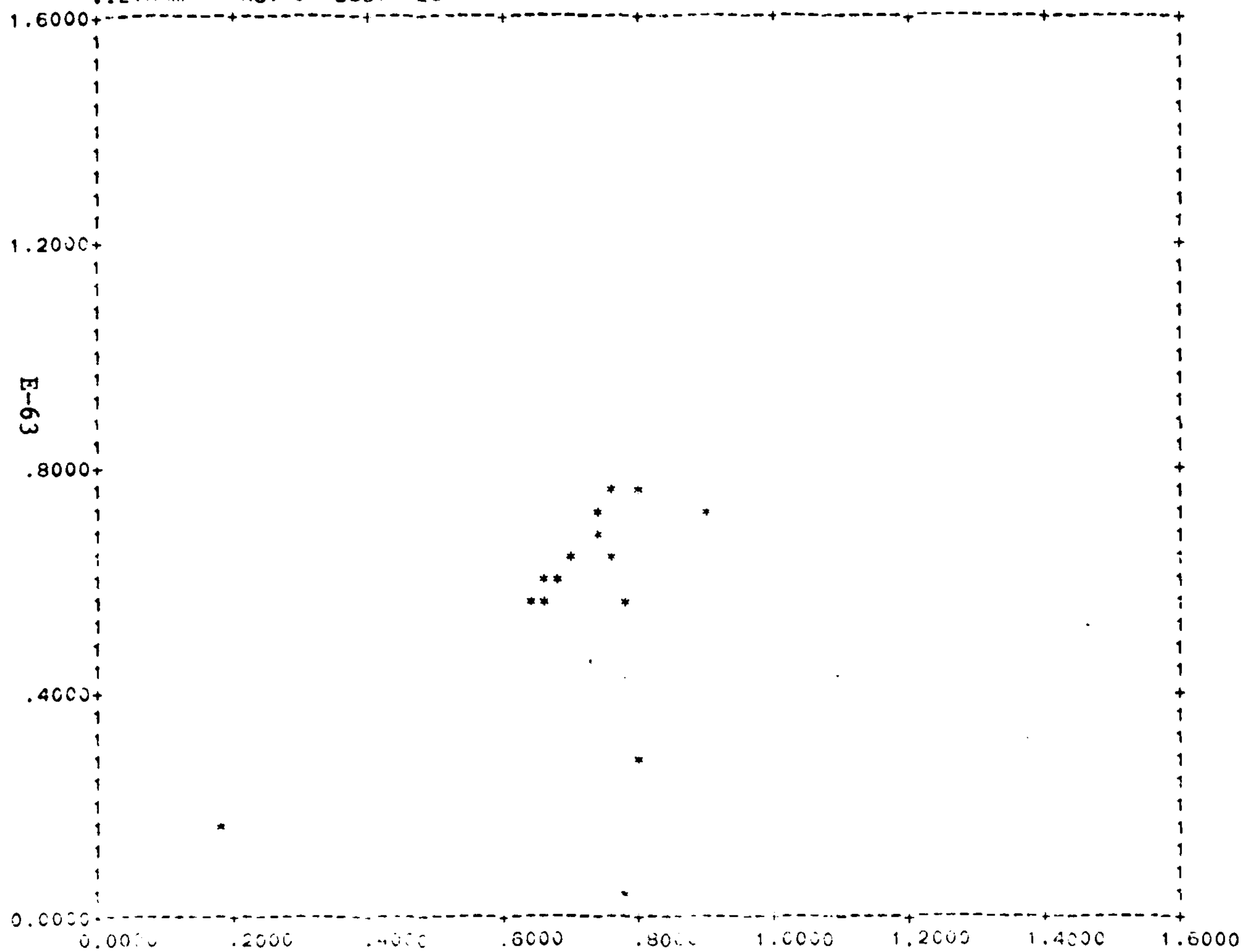


ANOVA TABLE

REGRESSION	DF=	1.	SS=	17.76221859054	MS=	17.76221859054
RESIDUAL	DF=	53.	SS=	.4946174094583	MS=	.009332403952044
TOTAL	DF=	54.	SS=	18.256836		

F-TEST= 1903.28437151
R**2= 97.2907824255[illegible] S= .09660436818304 CORR EST= .8970740922595
B(1) EST= .9365493484457

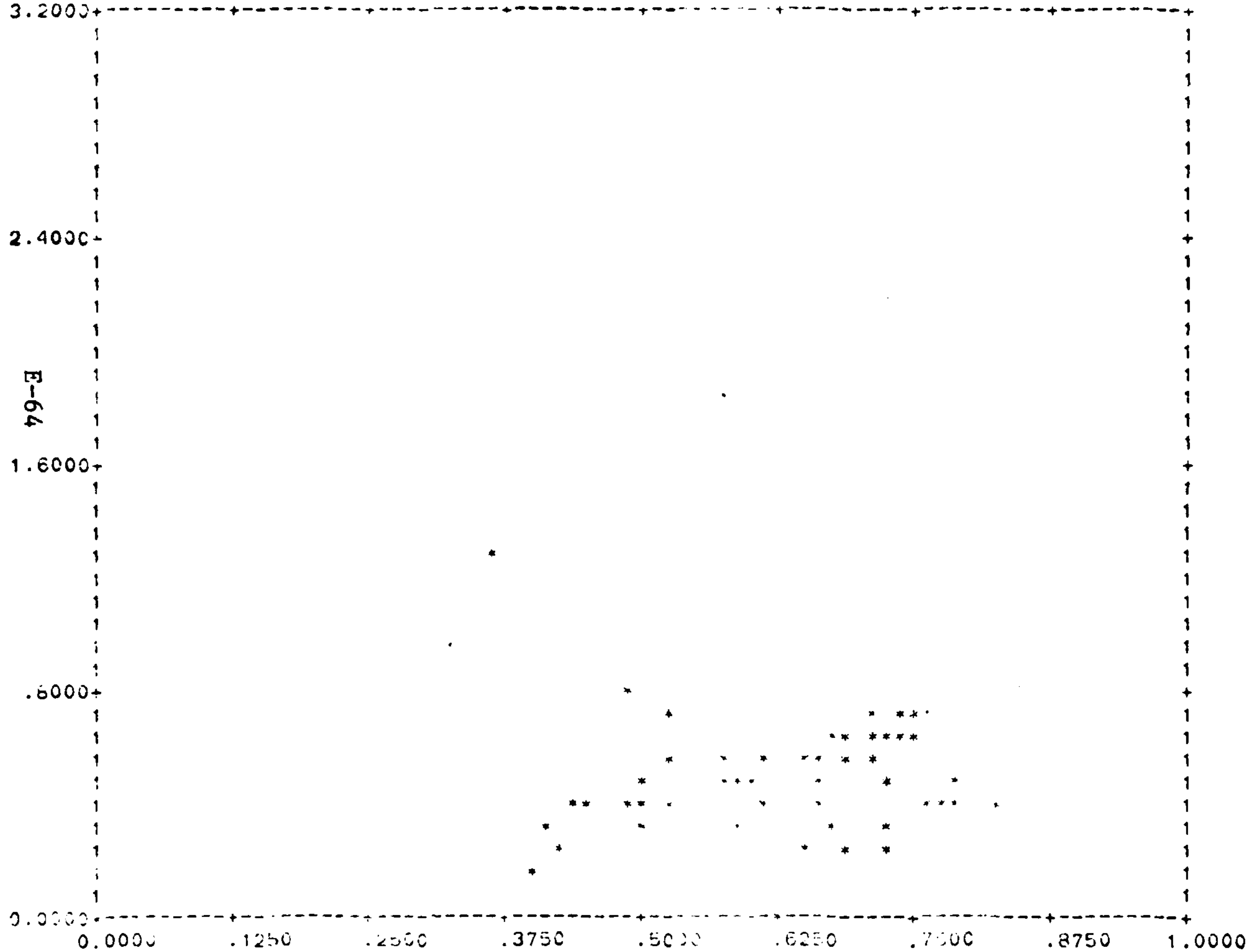
SYSTEM=AH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
VIETNAM NO. OF OBS. =23



ANOVA [illegible]

REGRESSION DF= 1. SS= [illegible].540041178744 MS [illegible].540041178744
RESIDUAL DF= 2[illegible]. [illegible] [illegible]0621255[illegible] [illegible] .0285[illegible]3219147[illegible]
TOTAL DF= 2[illegible]. SS= [illegible].188552
F-TEST= [illegible]
R**2= [illegible] [illegible] .[illegible]2322063[illegible]9 [illegible] [illegible]624328 [illegible]
B(1) EST= [illegible]

S STEM-CHART
YVARIABLE=   AVERAGE AVA...
XVARIABLE=   AVERAGE RELI...
WORLDWIDE   NO. OF OBS. =69

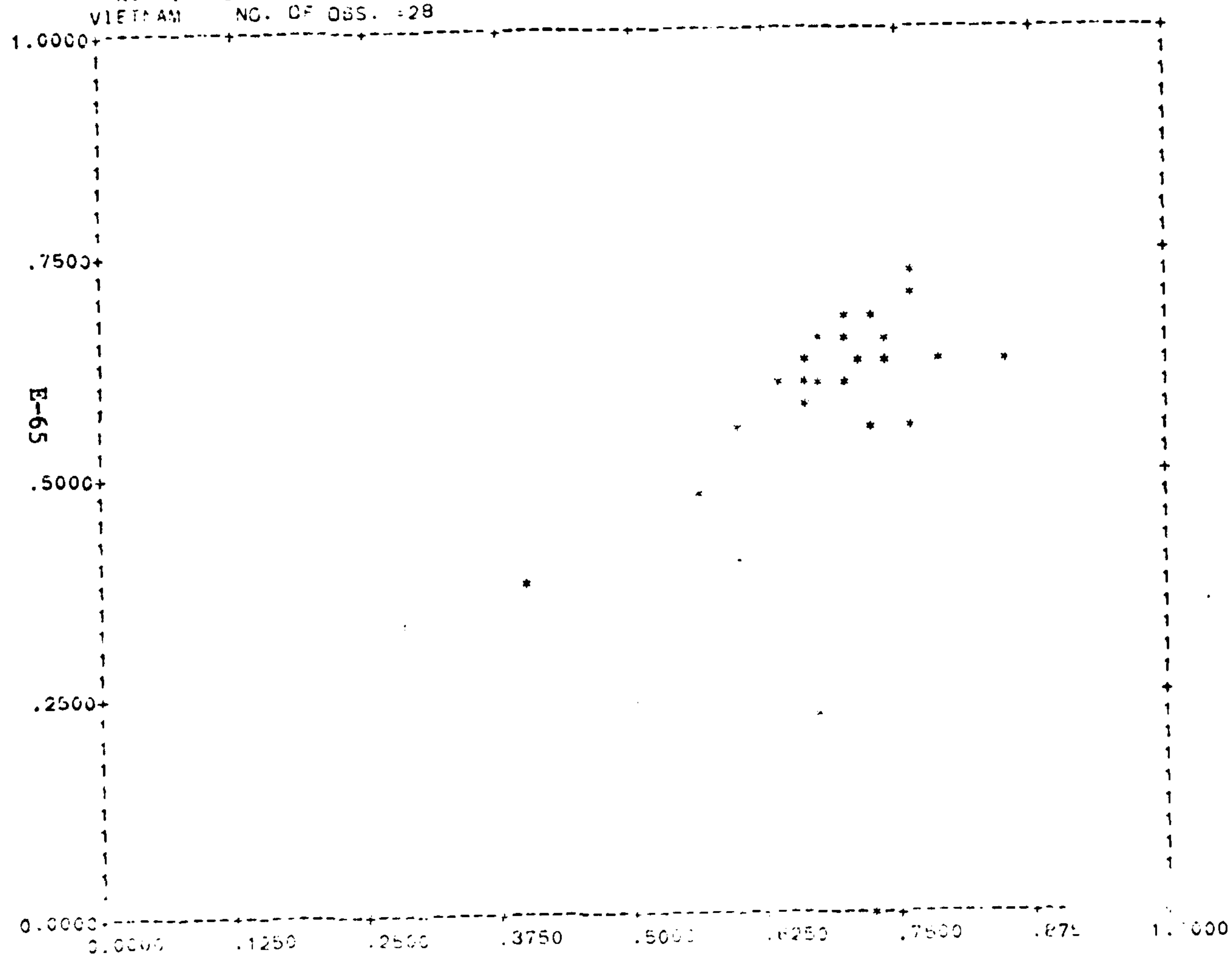


ANOVA TABLE

REGRESSION	DF=	1.	SS=	19.19624974027	MS=	19.19624974027
RESIDUAL	DF=	68.	SS=	4.732732259727	MS=	.06959900381952
TOTAL	DF=	69.	SS=	23.928982		

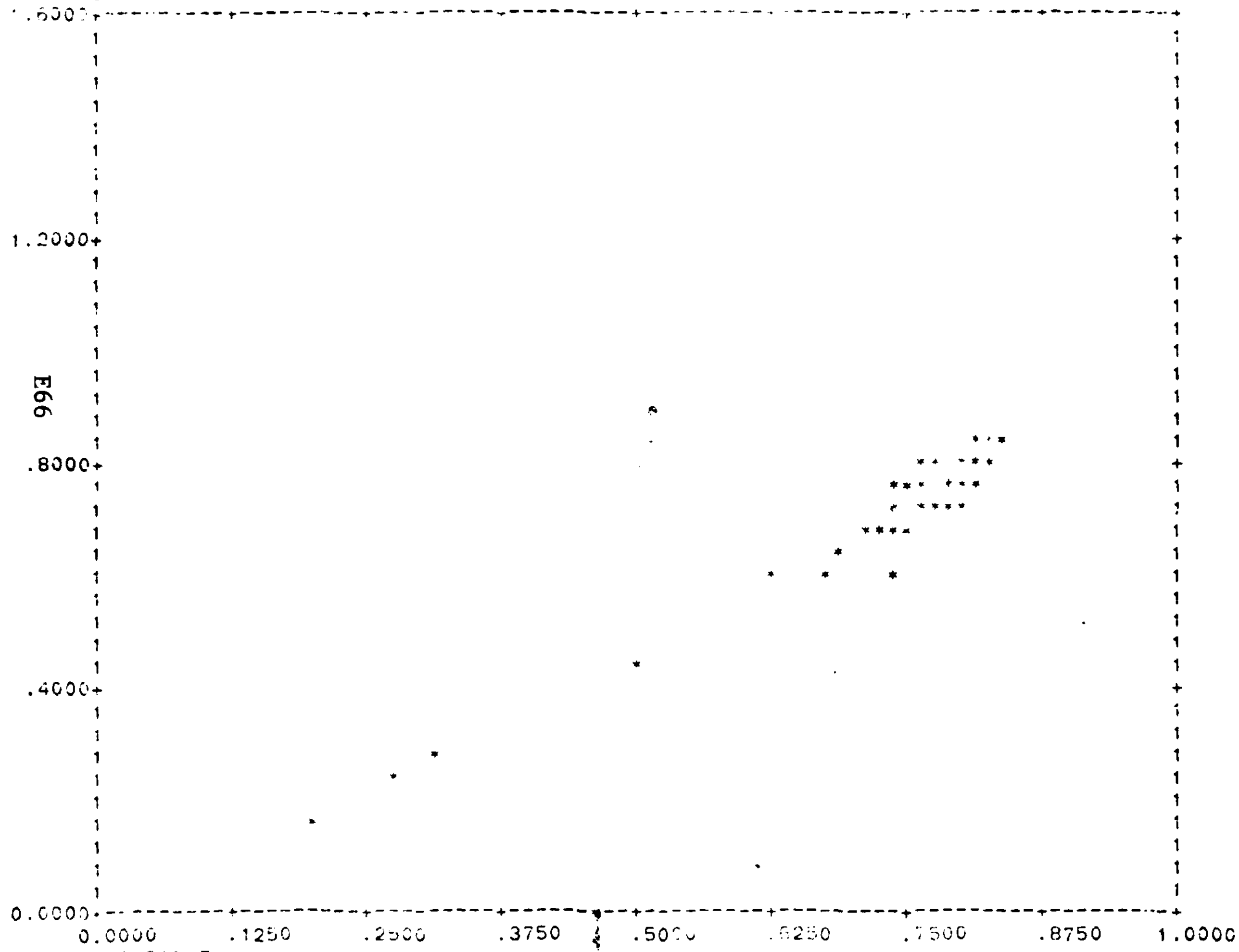
F-TEST= 275.8121300054
R**2= 80.22175878126   S= .2633162311525   CORR EST= .005328920111691
B(1) EST= .8260325827961

SYSTEM=CH47
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
VIETNAM NO. OF OBS. =28



ANOVA TABLE
REGRESSION DF= 1. SS= 9.037837386469 MS= [illegible]987827388469
RESIDUAL DF= 27. SS= [illegible]50115308 MS= [illegible]0578204[illegible]
TOTAL DF= 28. SS= 9.557823
F-TEST= 425.[illegible]
R**2= [illegible] B= [illegible]47975656 CORR= [illegible]
B(1) EST= [illegible]

SYSTEM-OH59
[illegible]VARIABLE= AVERAGE [illegible]
XVARIABLE= AVERAGE RELIABILITY
[illegible] NO. OF [illegible] 47

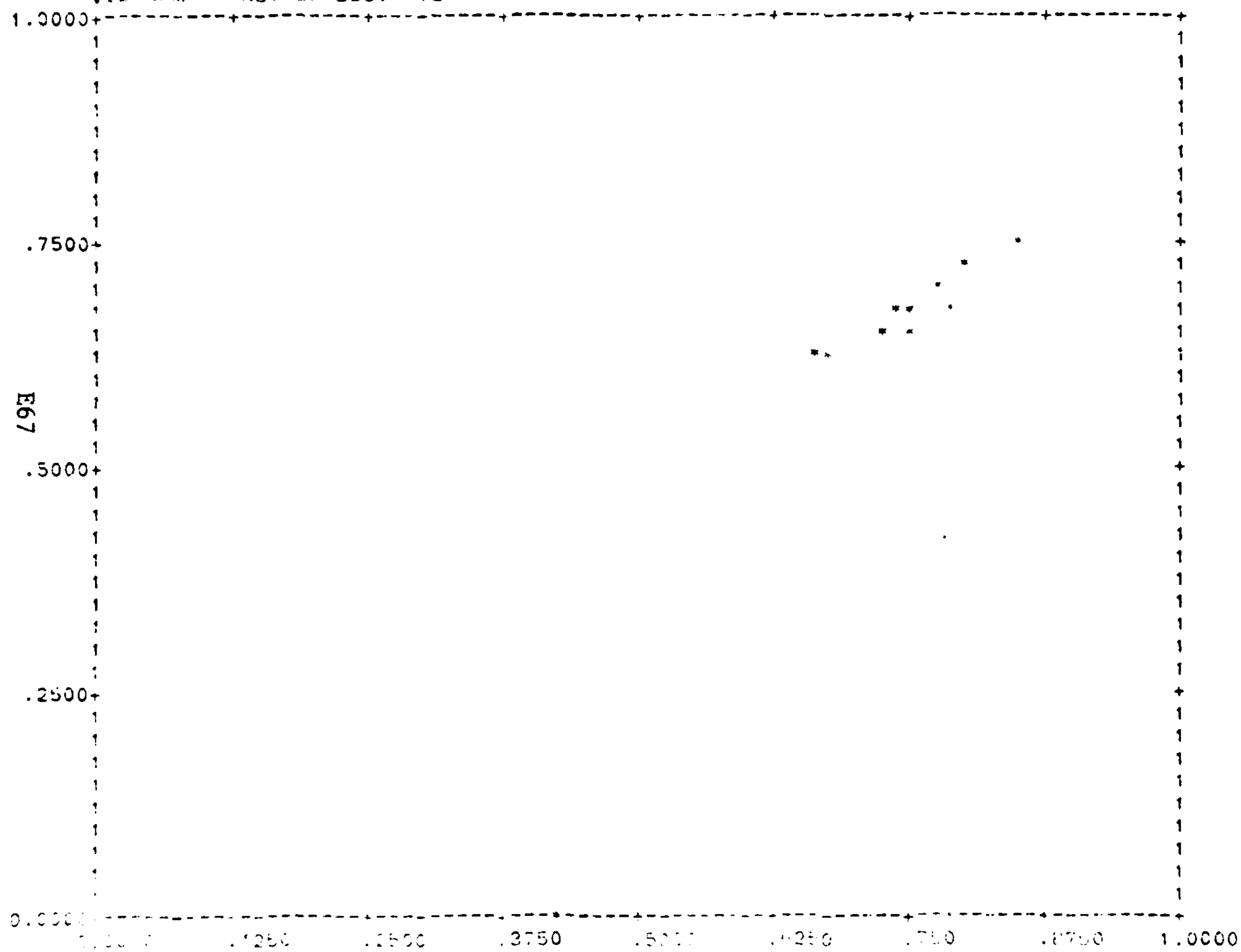


ANOVA TABLE

REGRESSION	DF=	1.	SS=	23.26151008461	MS=	23.26151008461
RESIDUAL	DF=	46.	SS=	.33872[illegible]9150935	MS=	.00730356337812
TOTAL	DF=	47.	SS=	23.600234		

F-TEST= 3159.[illegible]6121
R**2= [illegible] S= .085[illegible]120776519 CORR EST= .87547671[illegible]57
B(1) EST= .9495[illegible]743105

SYSTEM=OH58
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
VIETNAM NO. OF OBS. =12



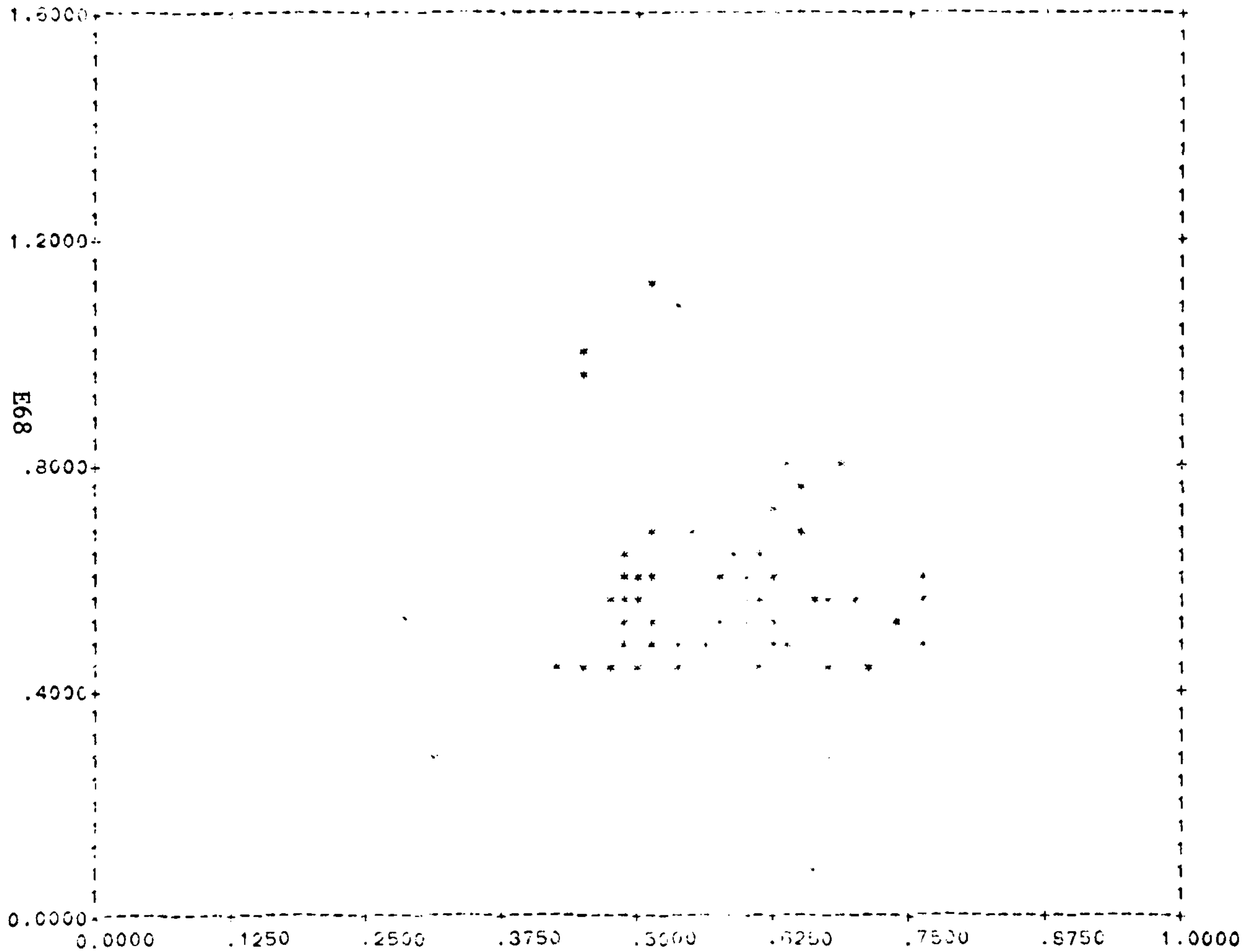
ANOVA TABLE

REGRESSION DF= 1. SS= [illegible]0375509667 MS= [illegible]
RESIDUAL DF= 11. [illegible]
TOTAL DF= 12. SS= [illegible]
F-TEST= [illegible]
R**2= [illegible]
B(1) EST= [illegible]

SYSTEM ...

AVERAGE ...

AVERAGE RELI... ITY



ANOVA TABLE

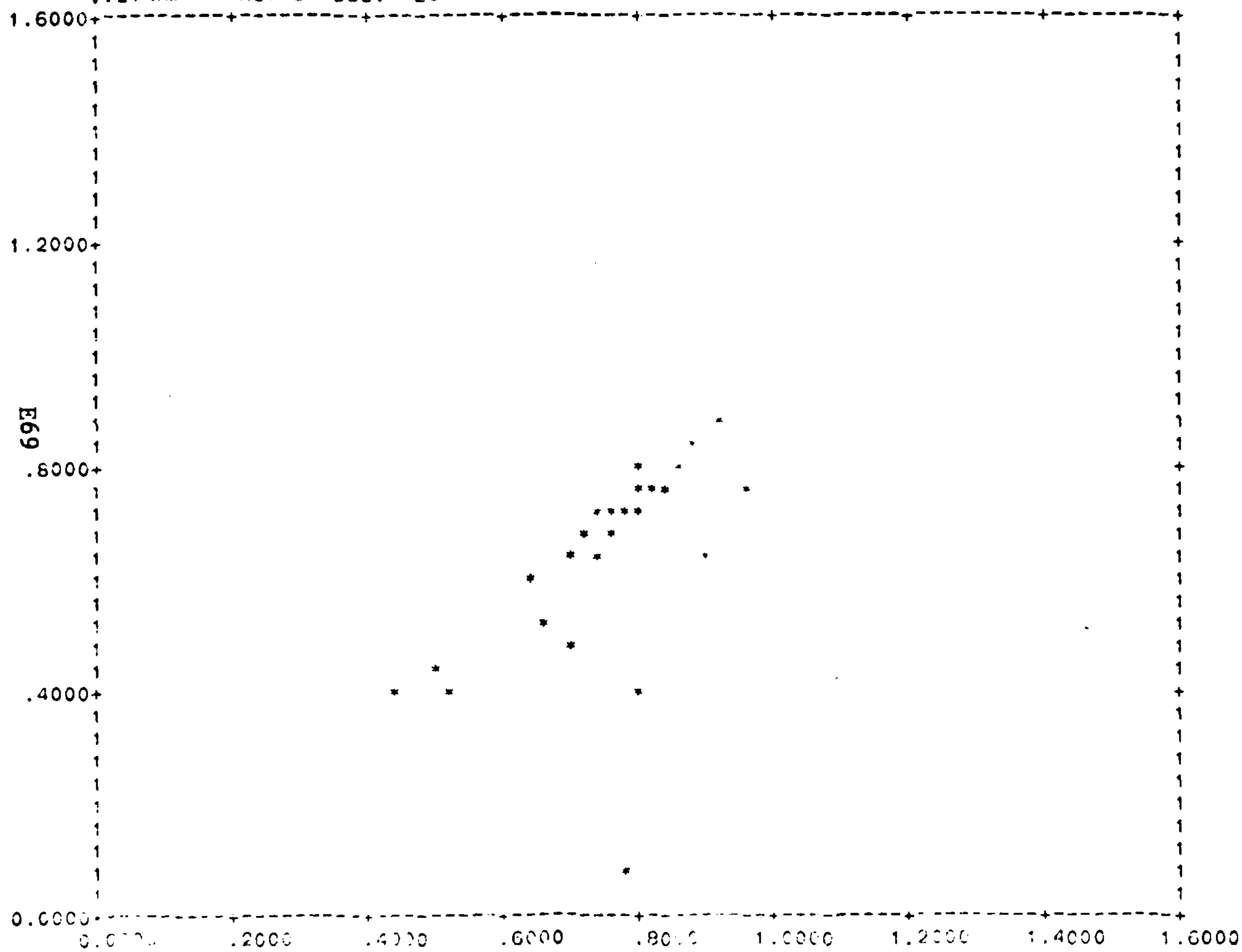
REGRESSION	DF= 1.	SS= 22.51198049718	MS= 22.51[illegible]049718
RESIDUAL	DF= 69.	SS= 2.777867502823	MS= .040[illegible]94931627
TOTAL	DF= 70.	SS= 25.292848	

F-TEST= [illegible].2540810757

R**2= 89.01718[illegible] S= .2006463289379 CORR EST= -.03905993268372

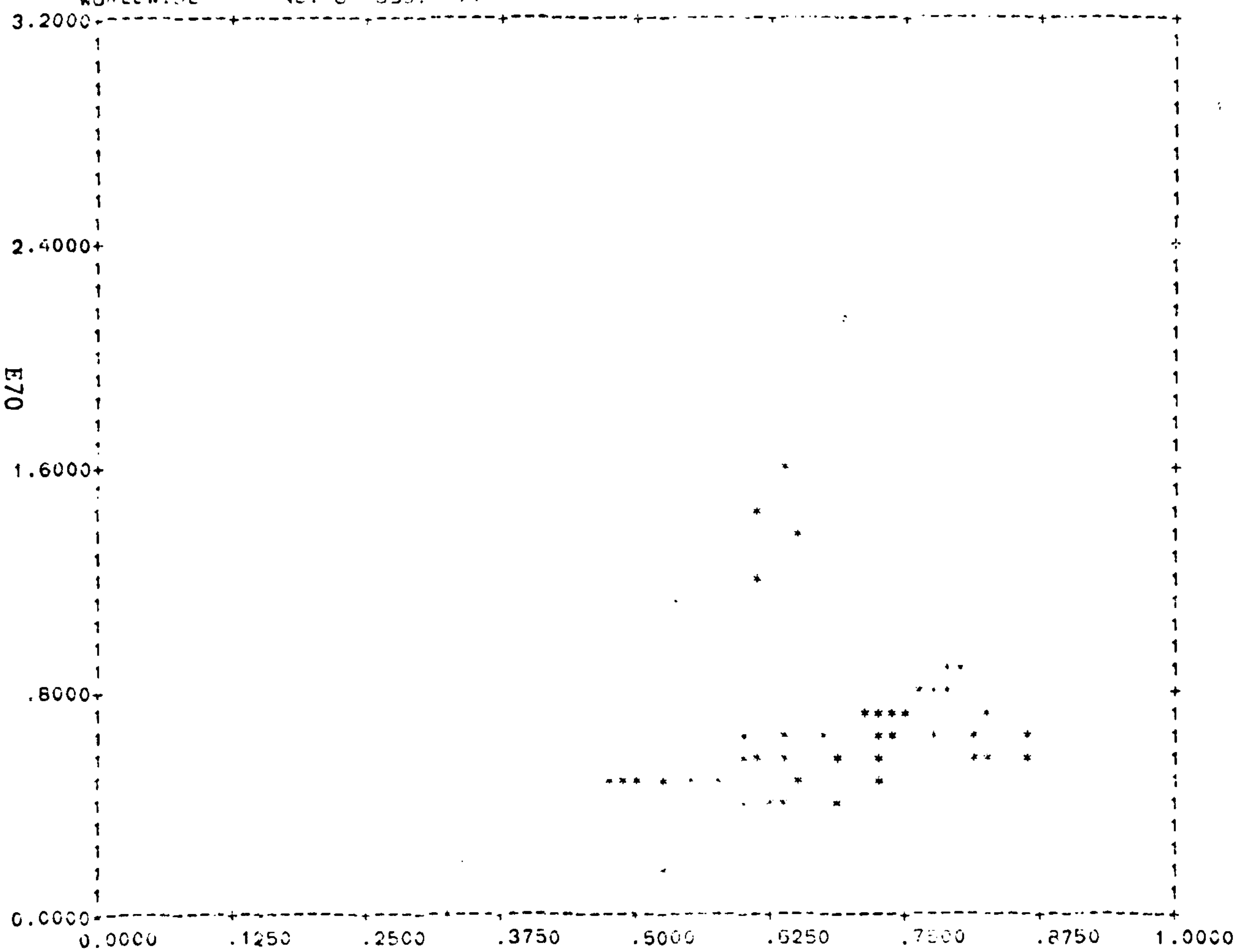
B(1) EST= .970420[illegible]93415[illegible]

SYSTEM=OV-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
VIETNAM NO. OF OBS. =29



ANOVA TABLE
REGRESSION DF= 1. SS= 12.77972102647 MS= 12.77972102647
RESIDUAL DF= 28. SS= .5282169735282 MS= .01886489191172
TOTAL DF= 29. SS= [illegible]307938
F-TEST= [illegible]7.4240874[illegible]04
R**2= [illegible] SE= [illegible]7349524614[illegible] [illegible] [illegible]3651468[illegible]
B(1) EST= [illegible]5769799[illegible]

SYSTEM [illegible]
YVARIABLE= AVERAGE AVA[illegible]
XVARIABLE= AVERAGE RE[illegible]
WORLDWIDE NO. OF OBS. =71



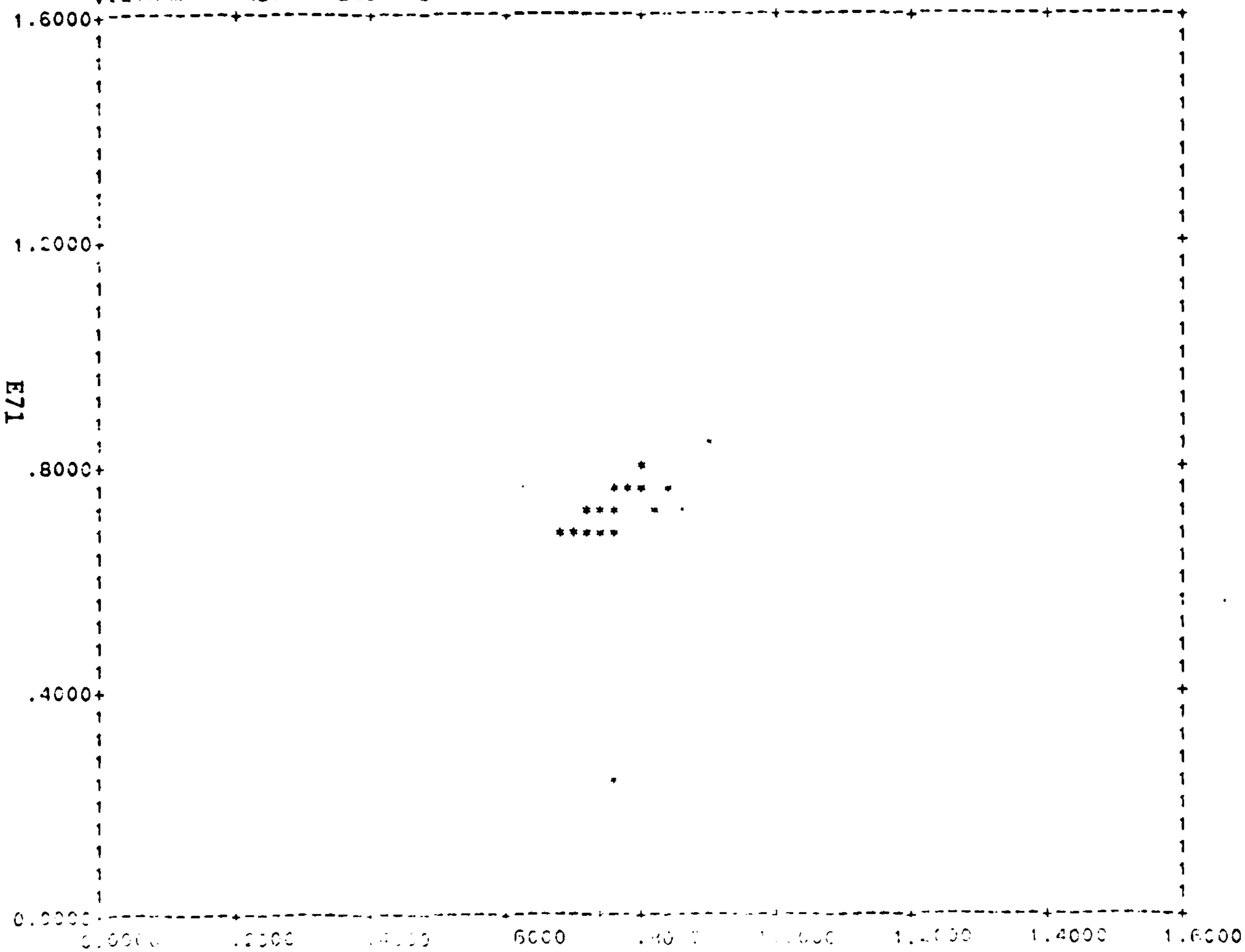
E70

ANOVA TABLE

REGRESSION	DF=	1.	SS=	31.79355727494	MS=	31.79355727494
RESIDUAL	DF=	70.	SS=	4.178141725058	MS=	.0596877389294
TOTAL	DF=	71.	SS=	35.971699		

F-TEST= 532.6647959064
R**2= 88.3849136974 S= .2443107425583 CORR EST= .3570731975315
B(1) EST= .9580503852599

SYSTEM-UH-1
YVARIABLE= AVERAGE AVAILABILITY
XVARIABLE= AVERAGE RELIABILITY
VIETNAM NO. OF OBS. =30



ANOVA TABLE
REGRESSION DF= 1. SS= [illegible]3.91633615551 MS= [illegible]615551
RESIDUAL DF= 2[illegible]. SS= [illegible]58[illegible]4801 MS= [illegible]
TOTAL DF= 30. SS= 14.557822
F-TEST= [illegible]
R**2= [illegible] S= [illegible]1457296170646 CO[illegible] [illegible]
B(1) EST= [illegible]

E71

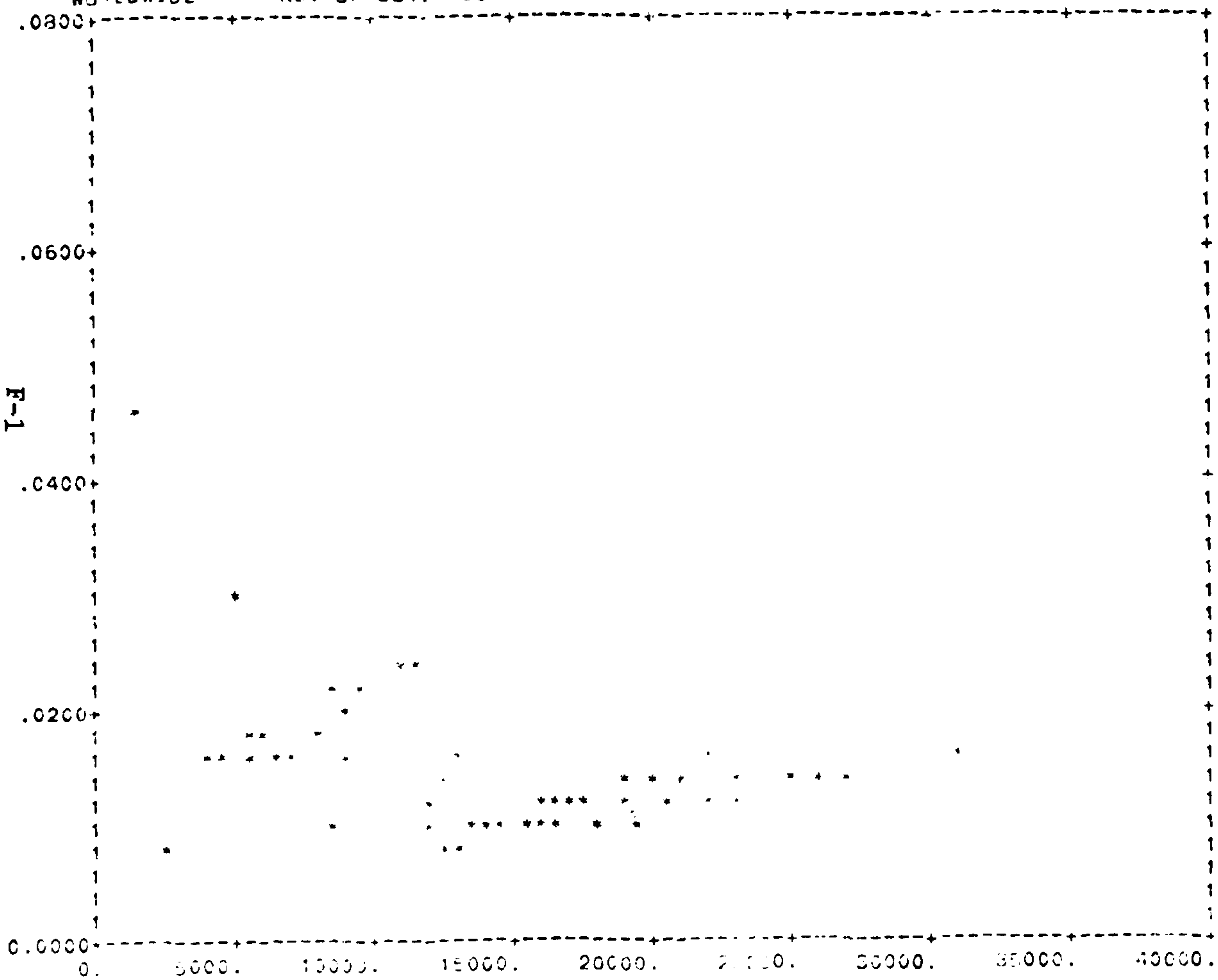
APPENDIX F

CAUSAL VARIABLES

REGRESSION ANALYSIS

Y VARIABLE (DEPENDENT	X VARIABLE (INDEPENDENT)
USAGE	TOTAL FLYINC HOURS
LENGTH OF SORTIES (BY AIRCRAFT)	TOTAL FLYING HOURS
LENGTH OF SORTIES (BY AIRCRAFT)	USAGE

SYSTEM=AH-1
YVARIABLE= AVERAGE USAGE
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =55



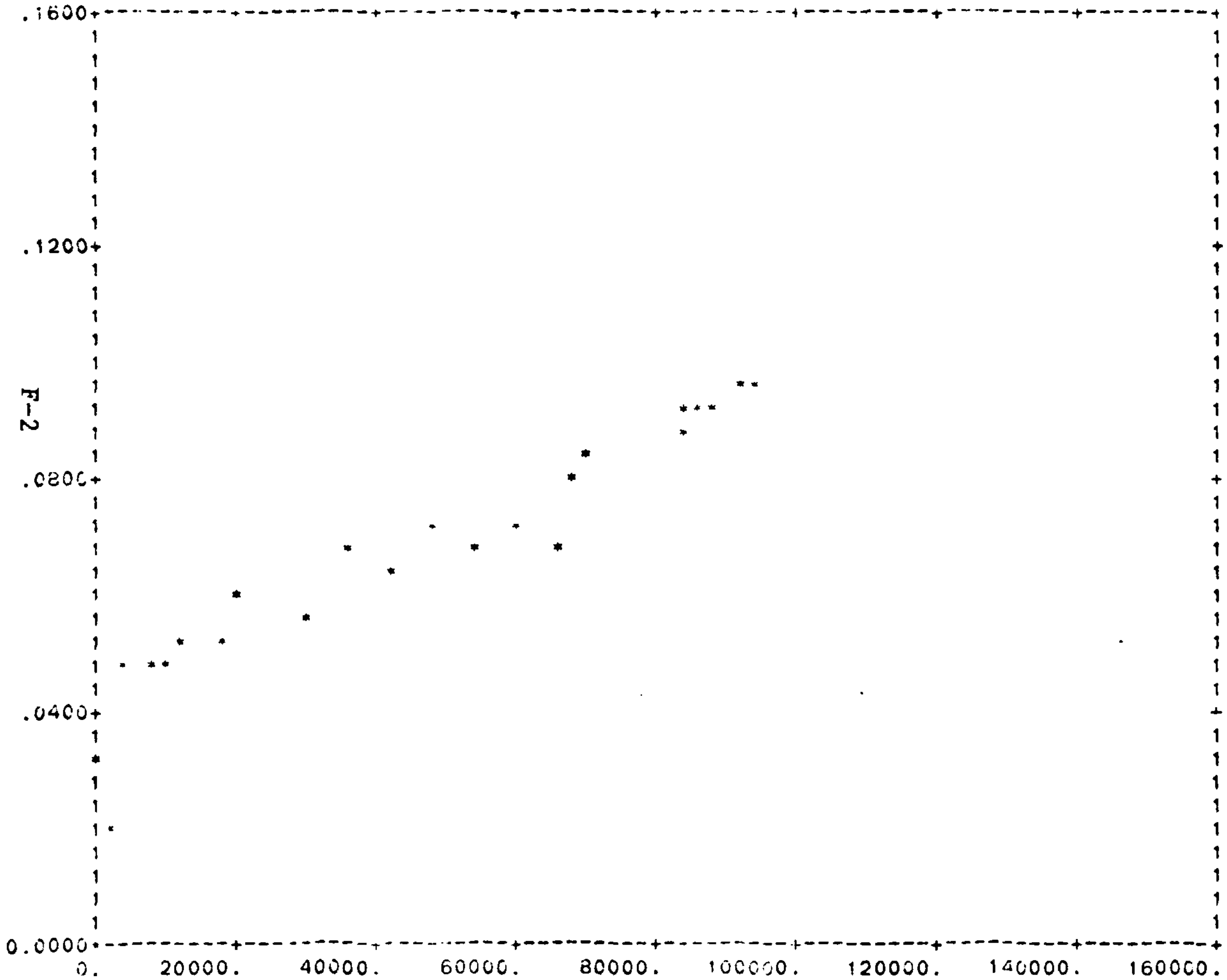
ANOVA TABLE

REGRESSION	DF=	1.	SS=	.007801776676543	MS=	.007801776676543
RESIDUAL	DF=	54.	SS=	[illegible]5507223323456	[illegible]	.000107541172[illegible]
TOTAL	DF=	55.	SS=	[illegible]		

F-TEST= [illegible]19737
R**2= [illegible] SE= [illegible]3702060084 [illegible] -.4082259916[illegible]
B(1) EST= [illegible]

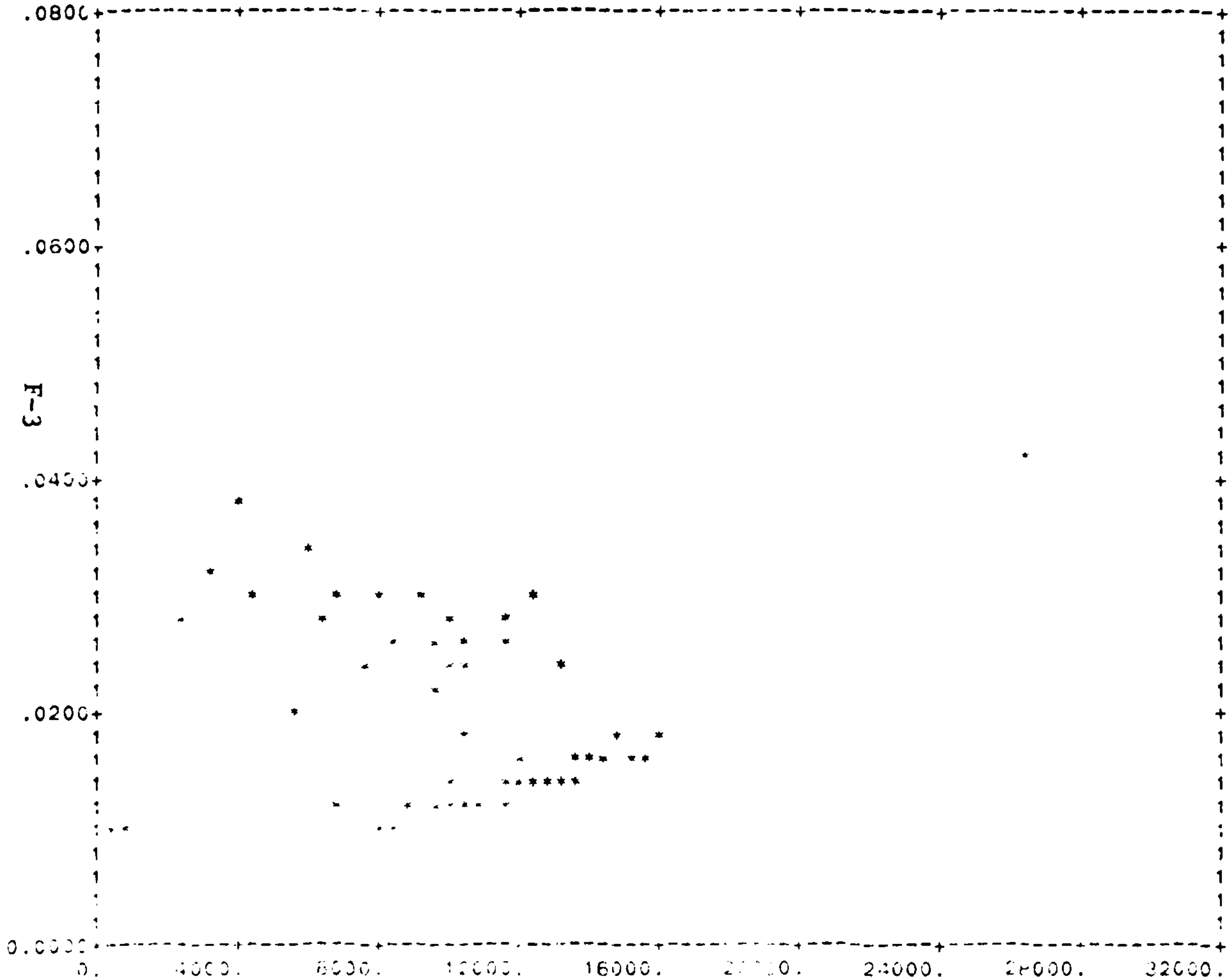
F-1

SYSTEM=AH-1
YVARIABLE= AVERAGE USE
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =23



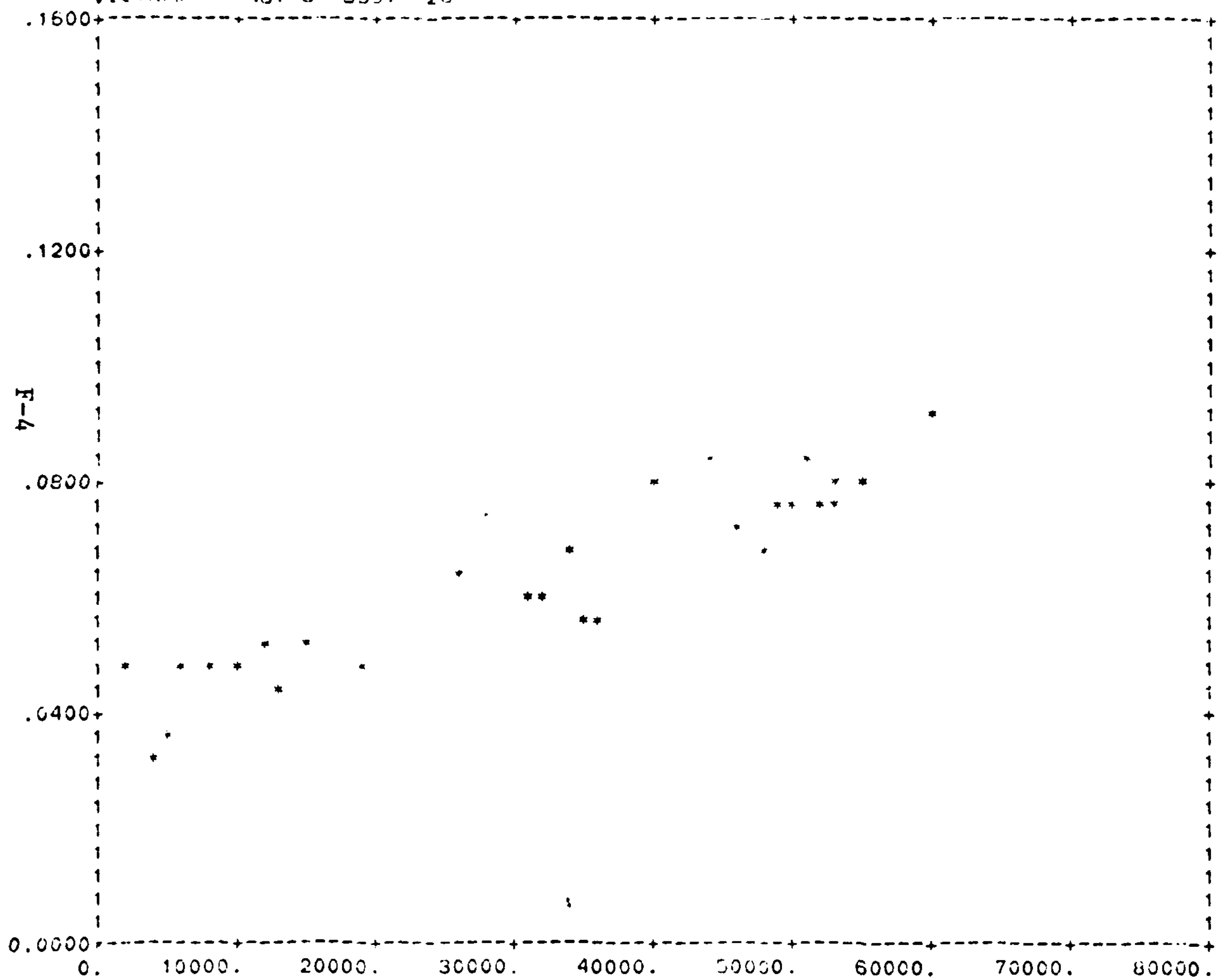

```
ANOVA TABLE
REGRESSION    DF=   1.   SS=   .09937229556408   MS=   .09937229556408
RESIDUAL      DF=  22.   SS=   .01215370443592   MS=   .0005524411107237
TOTAL         DF=  23.   SS=   .111526
F-TEST=   179.8785311866
R**2=   89.10235780363     S=   .02350406583389   CORR EST=   .9494134050422
B(1) EST=   .000001157334622037
```

SYSTEM=CH47
YVARIABLE= AVERAGE USAGE
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =65



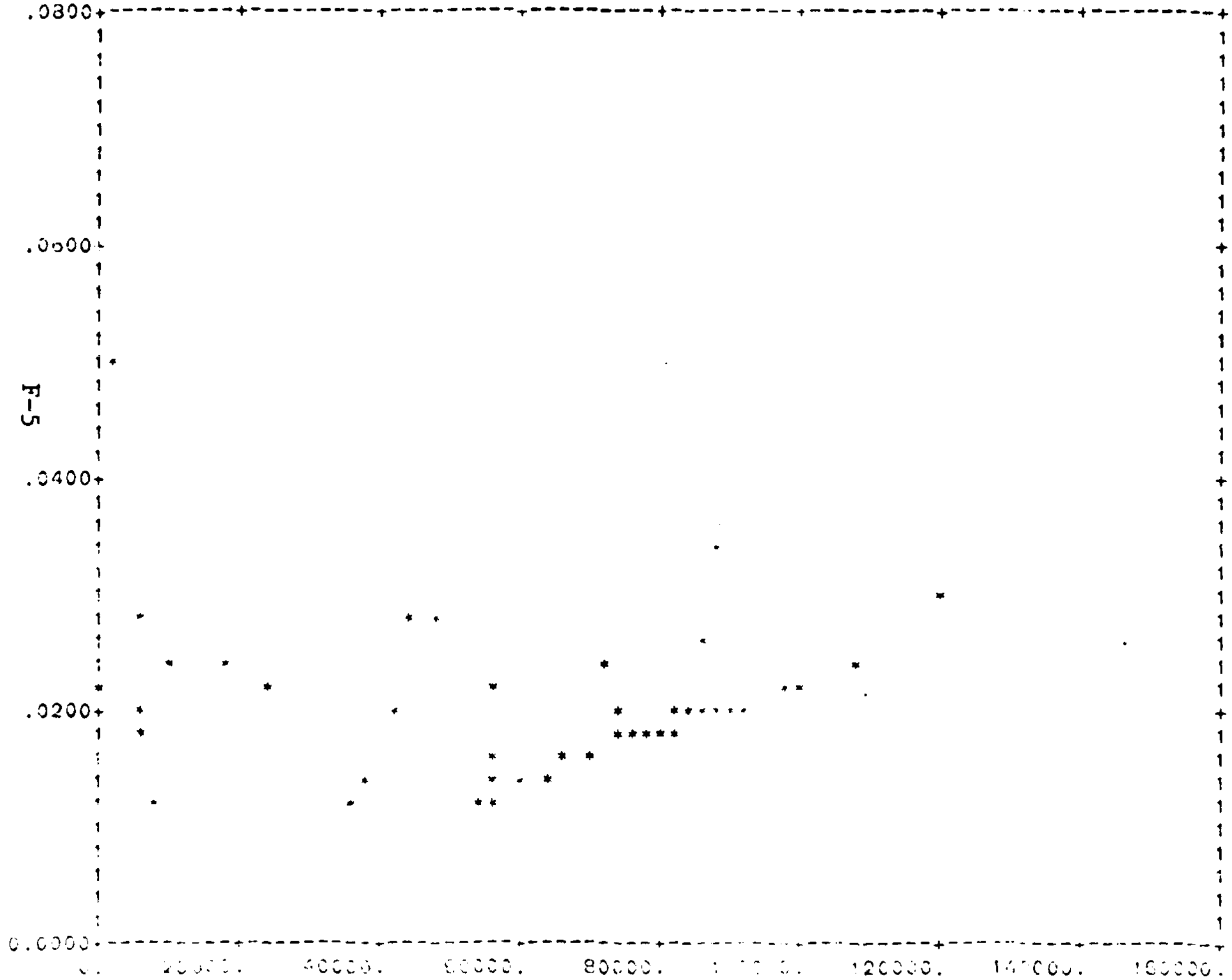
ANOVA TABLE
REGRESSION DF= [illegible] .00[illegible]22761494 [illegible] .02031122761494
RESIDUAL [illegible] .[illegible]7218772380[illegible] [illegible] .0001129495[illegible]
TOTAL DF= 65. [illegible] .02754
F-TEST [illegible]
R-2 [illegible] .0[illegible]17345[illegible] [illegible] -.0550301[illegible]
B[illegible] BETA .000[illegible]

```
SYSTEM=CH-47
     YVARIABLE=                    AVERAGE US  E
     XVARIABLE=                   TOTAL FLYIN  H  RS
   VIETNAM     NO. OF OBS. =28
```



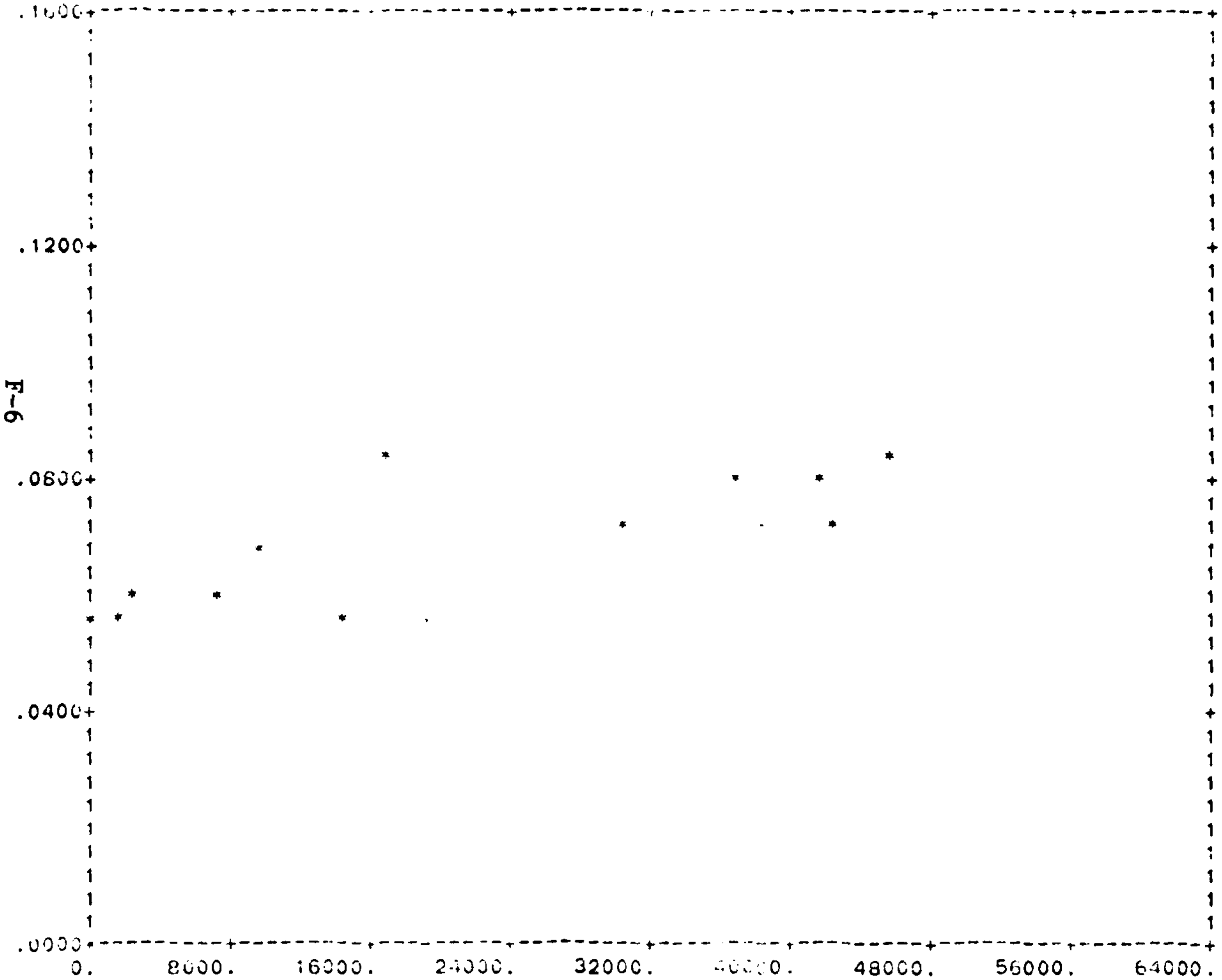

```
   ANOVA TABLE
REGRESSION     DF=   1.    SS=   .1039646146268    MS=    .1039646146268
RESIDUAL       DF=   27.   SS=   .01148638537322   MS=    .00042542168048 96
TOTAL          DF=   28.   SS=   .115451
F-TEST=   244.3801512537
R**2=   90.05085675029      S=   .02062575284661   CORR EST=   .9184814032692
B(1) EST=    .0000016595488 16972
```

SYSTEM=OH58
YVARIABLE= AVERAGE USAGE
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =48



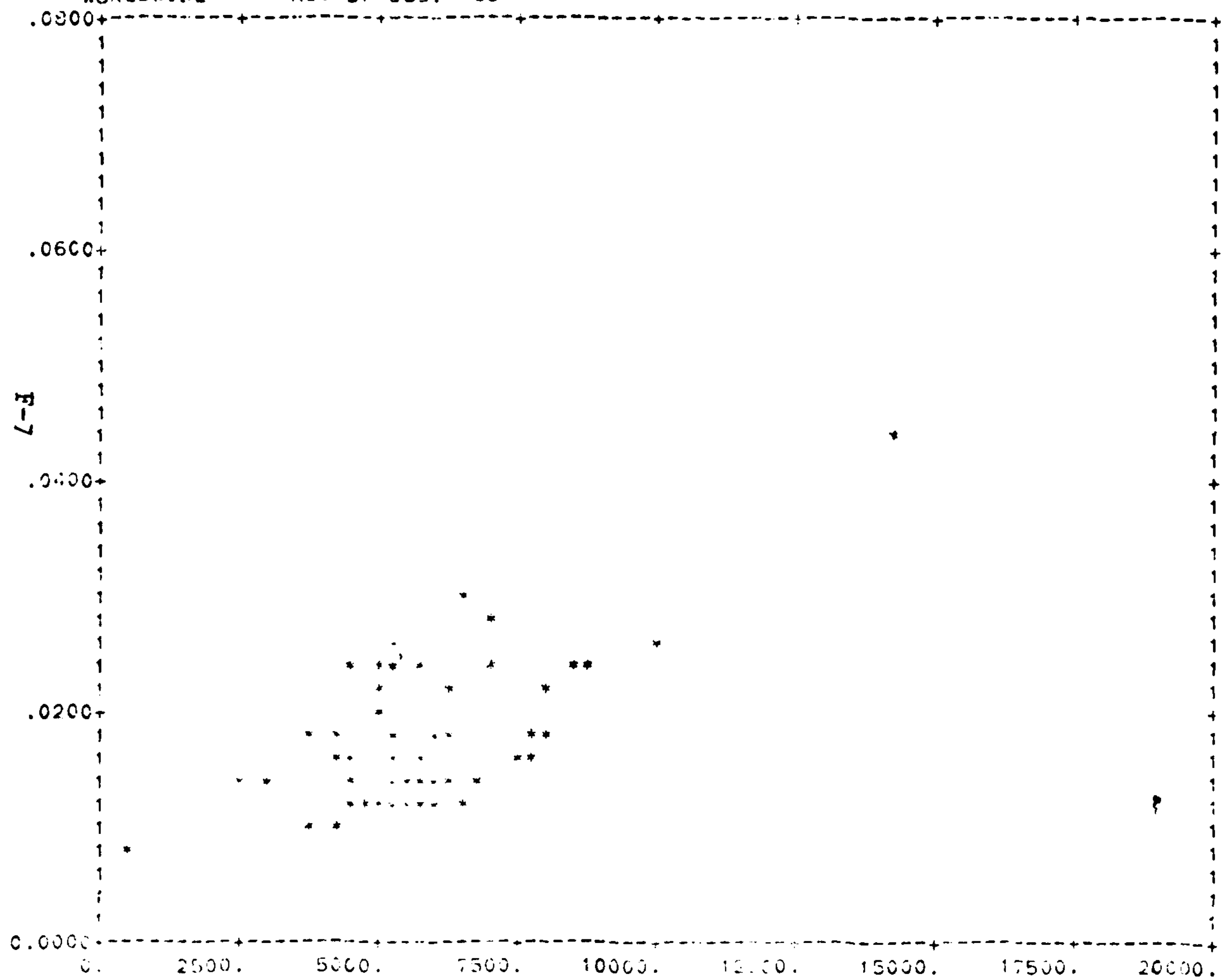
REGRESSION DF= 1. SS= .01475542621542 MS= .014755426215[illegible]
RESIDUAL DF= 47. SS= .00[illegible]057[illegible]784[illegible]82 [illegible]
TOTAL DF= 48. SS= .021026
F-TEST= [illegible]
R**2= [illegible] [illegible] .0115[illegible]06044647[illegible] [illegible] = -.097[illegible]
BETA EST= [illegible]

```
SYSTEM=
  TABLE=                              AVERAGE
  XVARIABLE=                          TOTAL FLYIN
VIETNAM     NO. OF OBS.
```

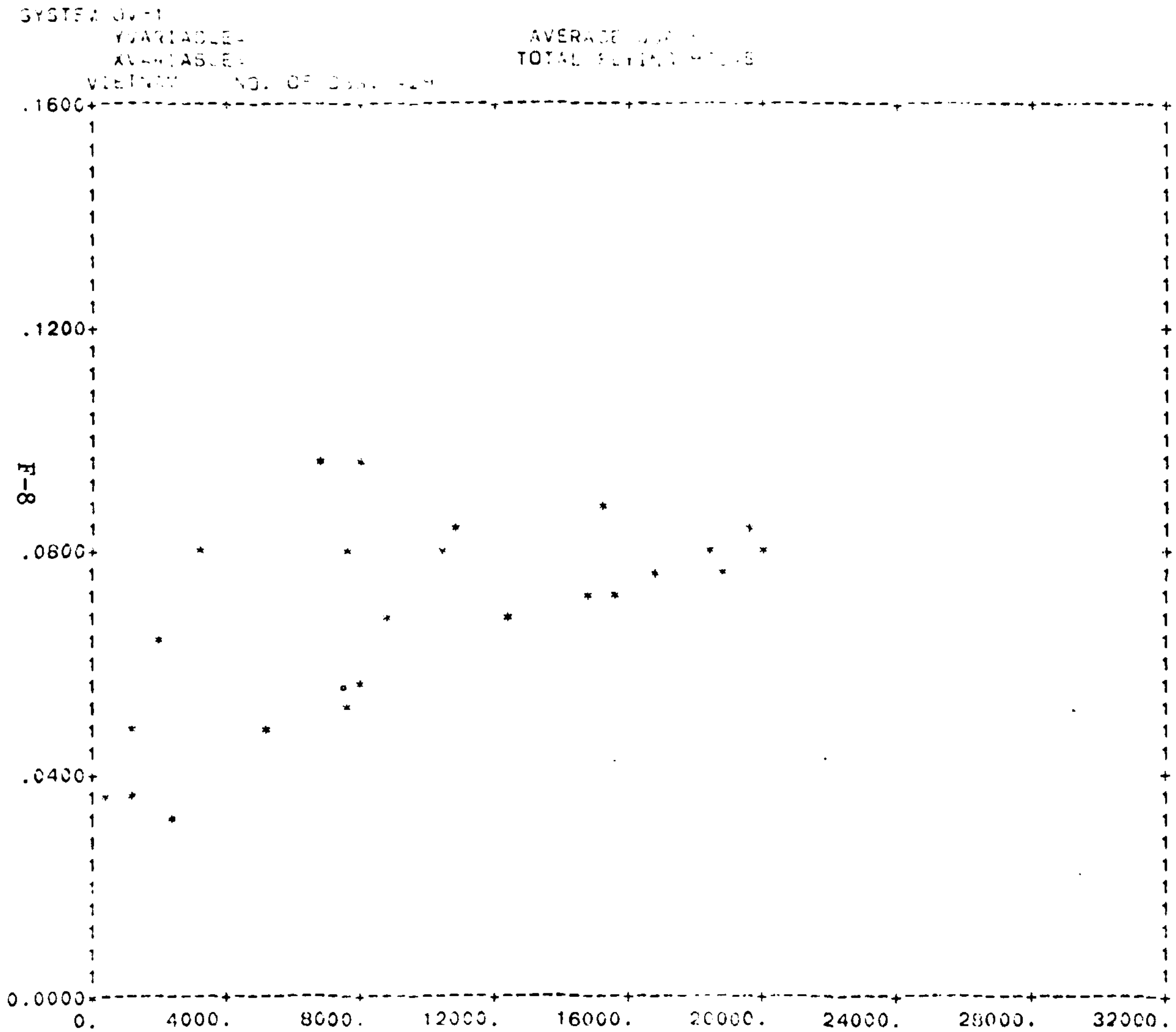


```
ANOVA TABLE
R  ESSION      DF=   1.   SS=   .04924336997991   MS=   .04924336997991
RESIDUAL       DF=  13.   SS=   .01679463002009   MS=   .00129189461693
TOTAL          DF=  14.   SS=   .066038
F-TEST=   38.11717251128
R**2=   74.56823341093      S=   .03594293556361   CORR EST=   .7394819549004
B(1) EST=   .0000021771827803883
```

SYSTEM=OV-1
YVARIABLE= AVERAGE USAGE
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =65

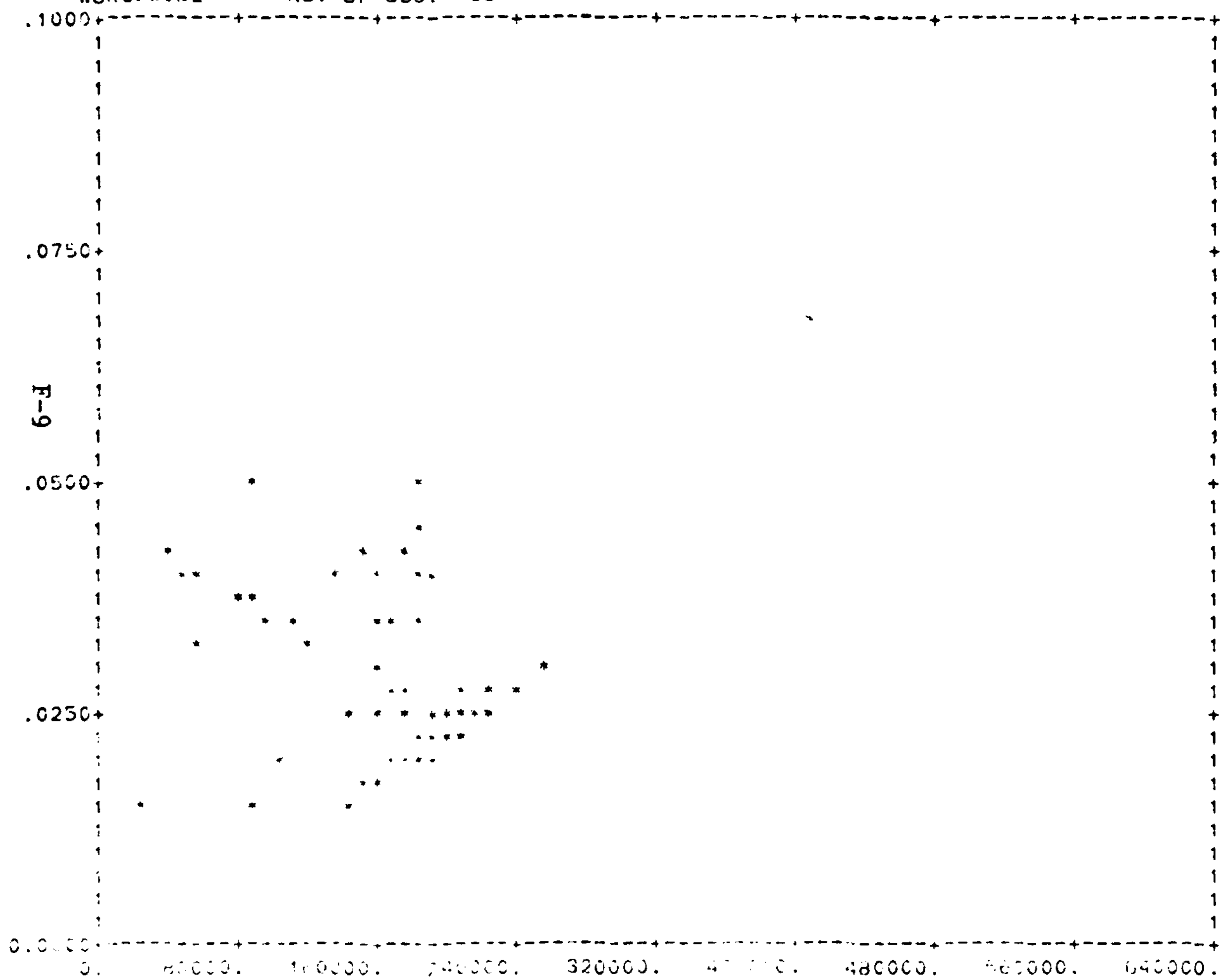


ANOVA TABLE
REGRESSION DF= 1. SS= .0189041308531 MS= .0189041308531
RESIDUAL DF= 64. SS= [illegible]1869146002 MS= .000025341705420[illegible]5
TOTAL DF= 65. SS= [illegible]26
F-TEST= [illegible]
R**2 [illegible] .6117[illegible]
B(1) EST= [illegible]



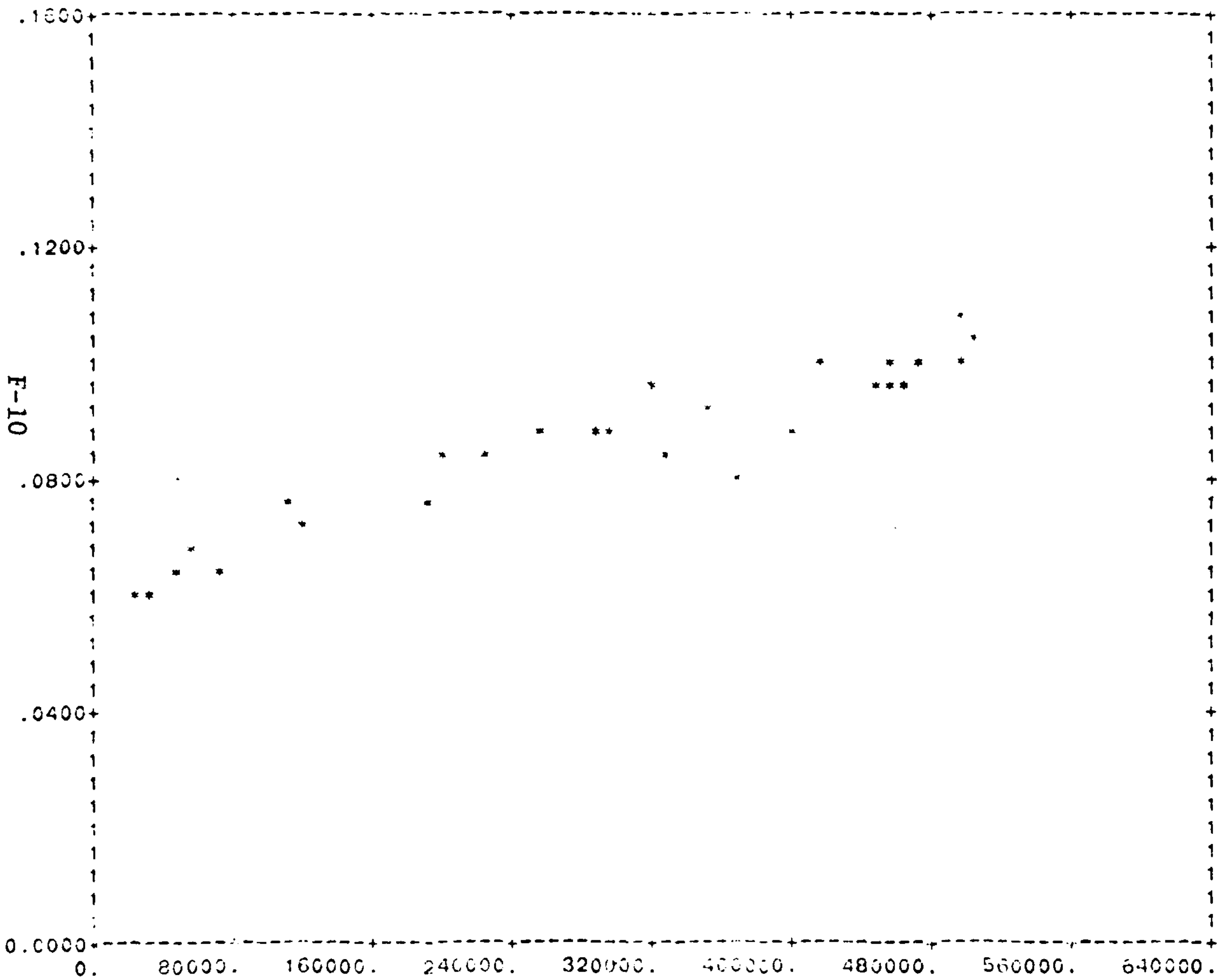

```
   ANOVA TABLE
REGRESSION    DF=   1.   SS=   .1232331332122   MS=   .1232331332122
RESIDUAL      DF=  28.   SS=   .0257238667878I   MS=   .00091870952813б1
TOTAL         DF=  29.   SS=   .148057
F-TEST=   134.1372103348
R**2=   82.73067610934      S=   .03031022151249   CORR EST=   .5697278855262
B(1) EST=   .00000548598248528?
```

SYSTEM=UH-1
YVARIABLE= AVERAGE USAGE
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =65



ANOVA TABLE
REGRESSION
RESIDUAL
TOTAL

SYSTEM=
VARIABLE= AVERAGE
VARIABLE= TOTAL FLYIN
VIETNAM NO. OF OBS. 30

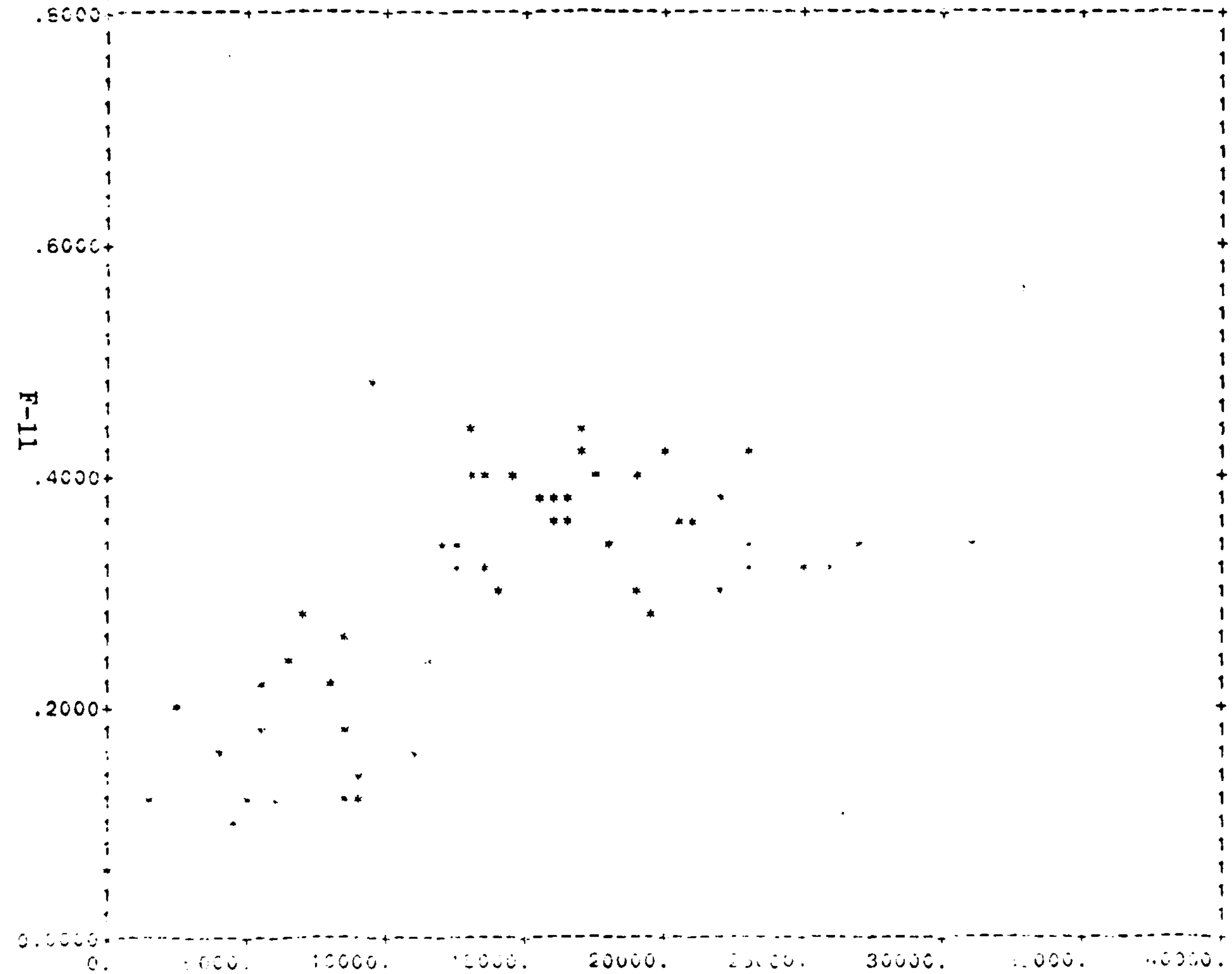


ANOVA TABLE

REGRESSION	DF= 1.	SS= .1960210569371	MS= .1960210569371	
RESIDUAL	DF= 29.	SS= .02908294306294	MS= .001002860105619	
TOTAL	DF= 30.	SS= .227104		

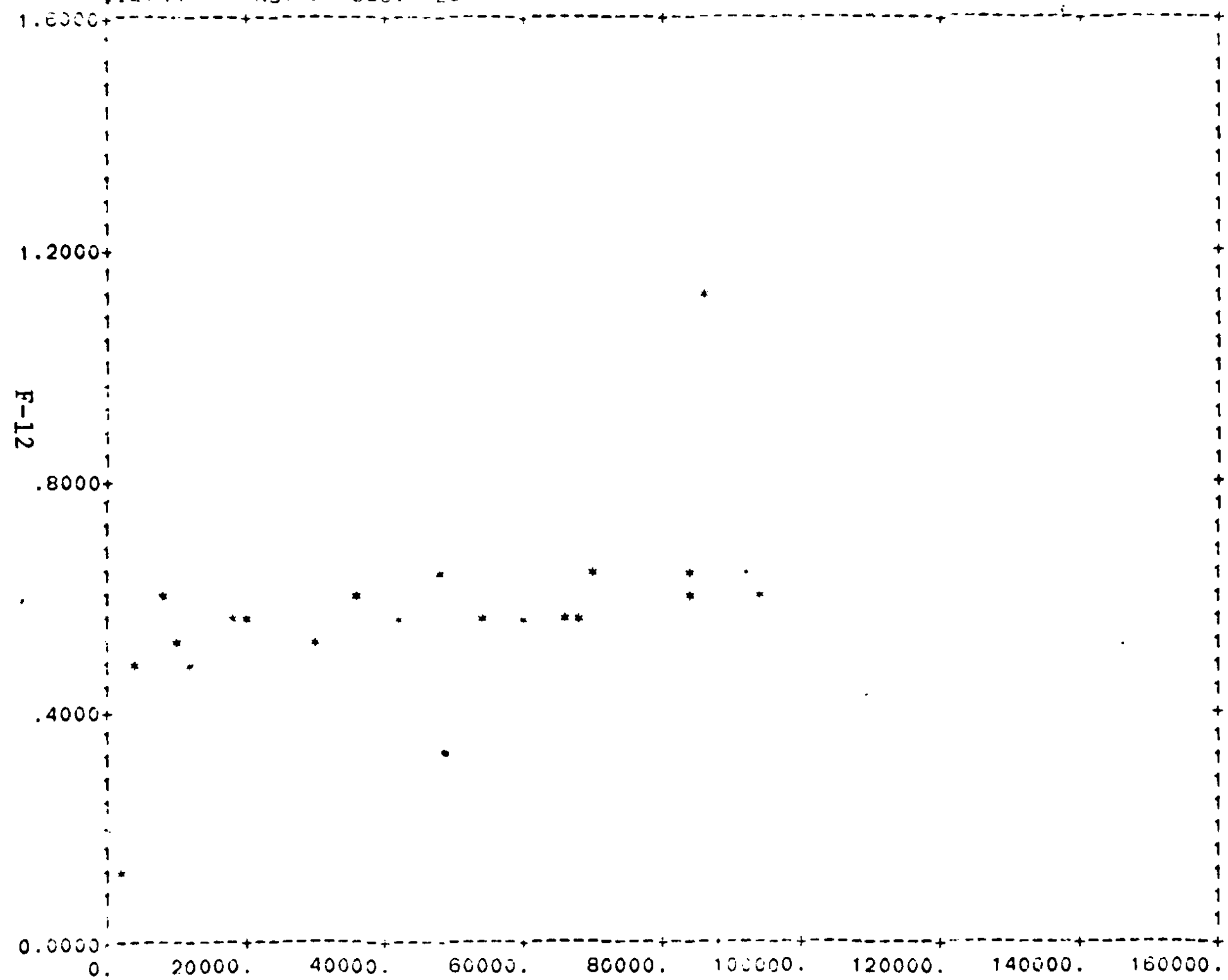
F-TEST= 197.4563110525
R**2= 87.19399727633 S= .03163796055326 CORR EST= .9378613874642
B(1) EST= 2.374632094675E-7

SYSTEM=A-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =55



ANOVA TABLE
REGRESSION DF= 1. SS .2-11077528466 MS= .0811077528466
RESIDUAL DF= 53. SS= .1475217744262 MS= [illegible]
TOTAL DF= 54. SS= .2200295272727
F-TEST= [illegible]
R**2= [illegible] CORRELATION EST= [illegible]
S= [illegible]
SLOPE EST= [illegible] INTERCEPT EST= [illegible]

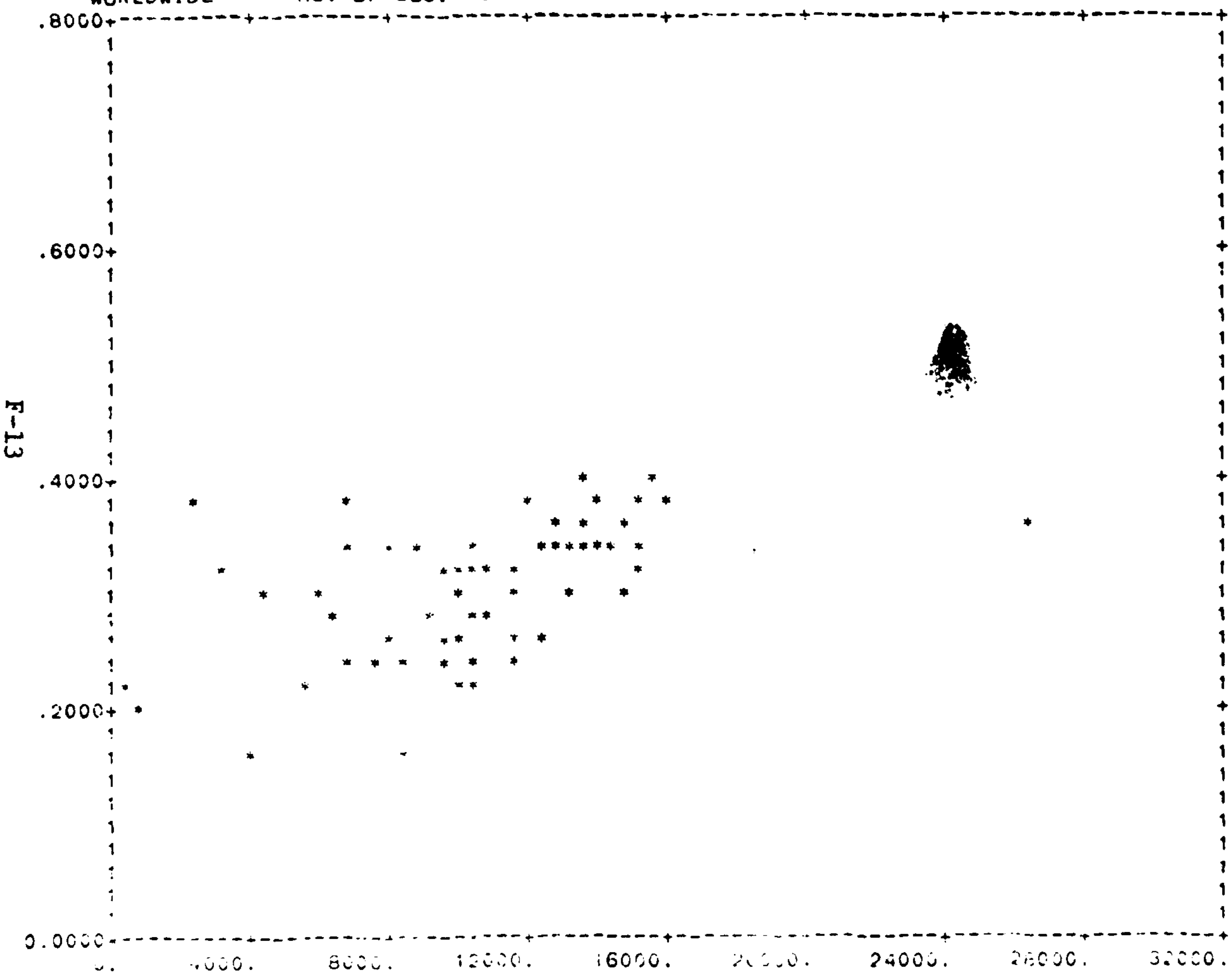
SYSTEM-AH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. 22



ANOVA TABLE

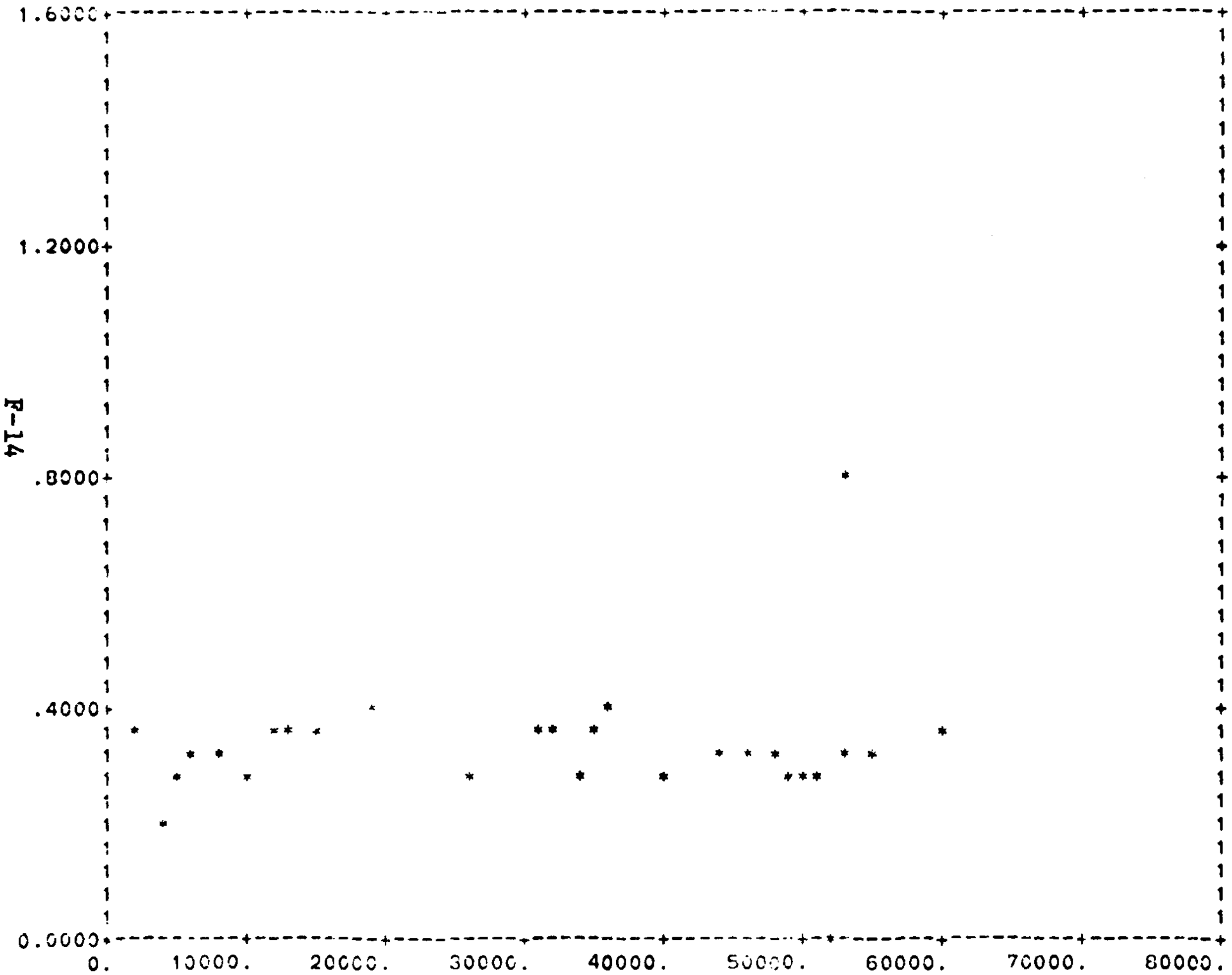
```
REGRESSION   DF=  1.   SS=  .288977179623   MS=  .288977179623
RESIDUAL     DF= 20.   SS=  .4229901385588  MS=  .02114950692794
TOTAL        DF= 21.   SS=  .7119673181818
F-TEST=  12.66354216236
R**2=  40.5[illegible]54560361      CORRELATION EST=  .6370[illegible]14032037
S=  .145428700496
SLOPE EST=  .00000360376529574?     INTERCEPT EST=  .4009741654907
```

SYSTEM=CH47
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =64



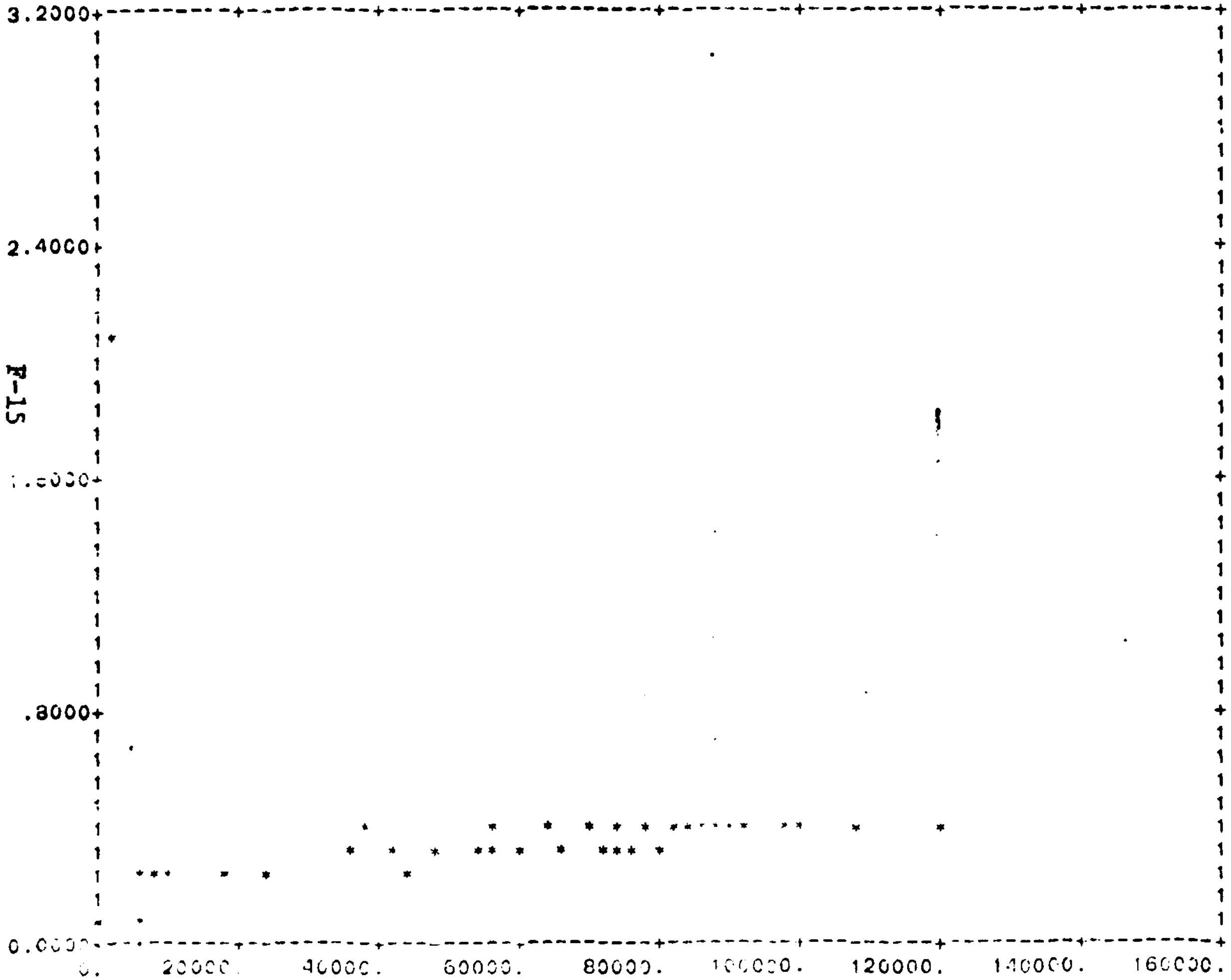
ANOVA TABLE
REGRESSION DF= 1. SS= .0623624519565 MS= .0623624519565
RESIDUAL DF= 62. SS= .15[illegible]54855435 MS= .00[illegible]023900[illegible]
TOTAL DF= 63. SS= .214[illegible]79575
F-TEST= [illegible]
R**2= [illegible] CORRELATION EST= .53[illegible]
S= .04[illegible]
SLOPE EST .0000075[illegible] INTERCEPT EST= .2[illegible]292056

```
SYSTEM=CH47
     YVARIABLE=                 AVERAGE LENGTH OF SORTIES BY AIRCRAFT
     XVARIABLE=                TOTAL FLYING HOURS
   VIETNAM     NO. OF OBS. =27
```



```
    ANOVA TABLE
REGRESSION      DF=   1.   SS=   .01641566536497   MS=   .01641566536497
RESIDUAL        DF=  25.   SS=   .2601124087091    MS=   .01040449634836
TOTAL           DF=  26.   SS=   .2765280740741
F-TEST=    1.5777472369
R**2=    5.936346759703      CORRELATION EST=     .2436461934795
S=    .1020024330512
SLOPE EST=    .000001331549224489      INTERCEPT EST=    .3026507102893
```

SYSTEM=OH58
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =47

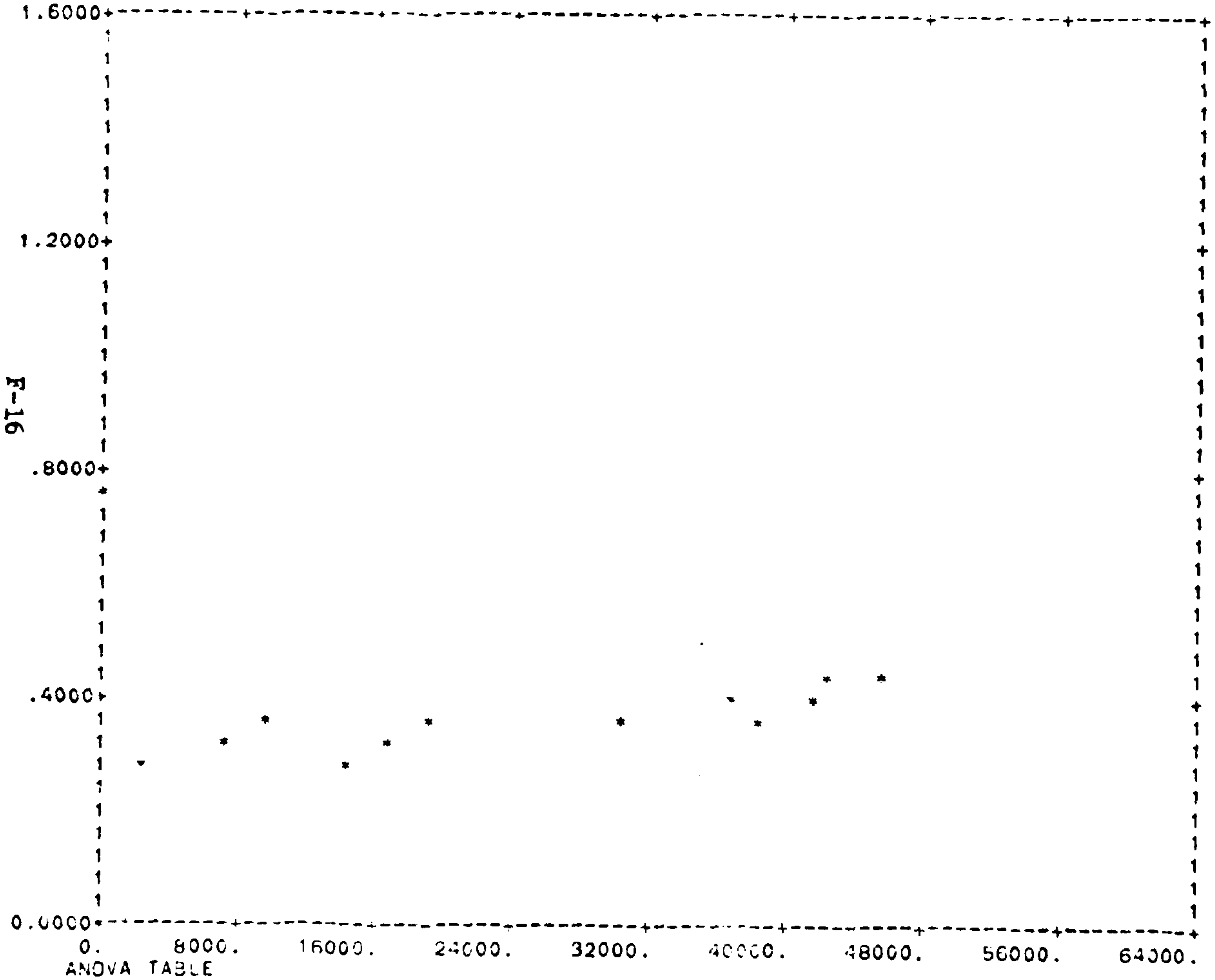


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.01258473341963	MS=	.01258473341963
RESIDUAL	DF=	45.	SS=	3.115850245304	MS=	.06924111656231
TOTAL	DF=	46.	SS=	3.128434978723		

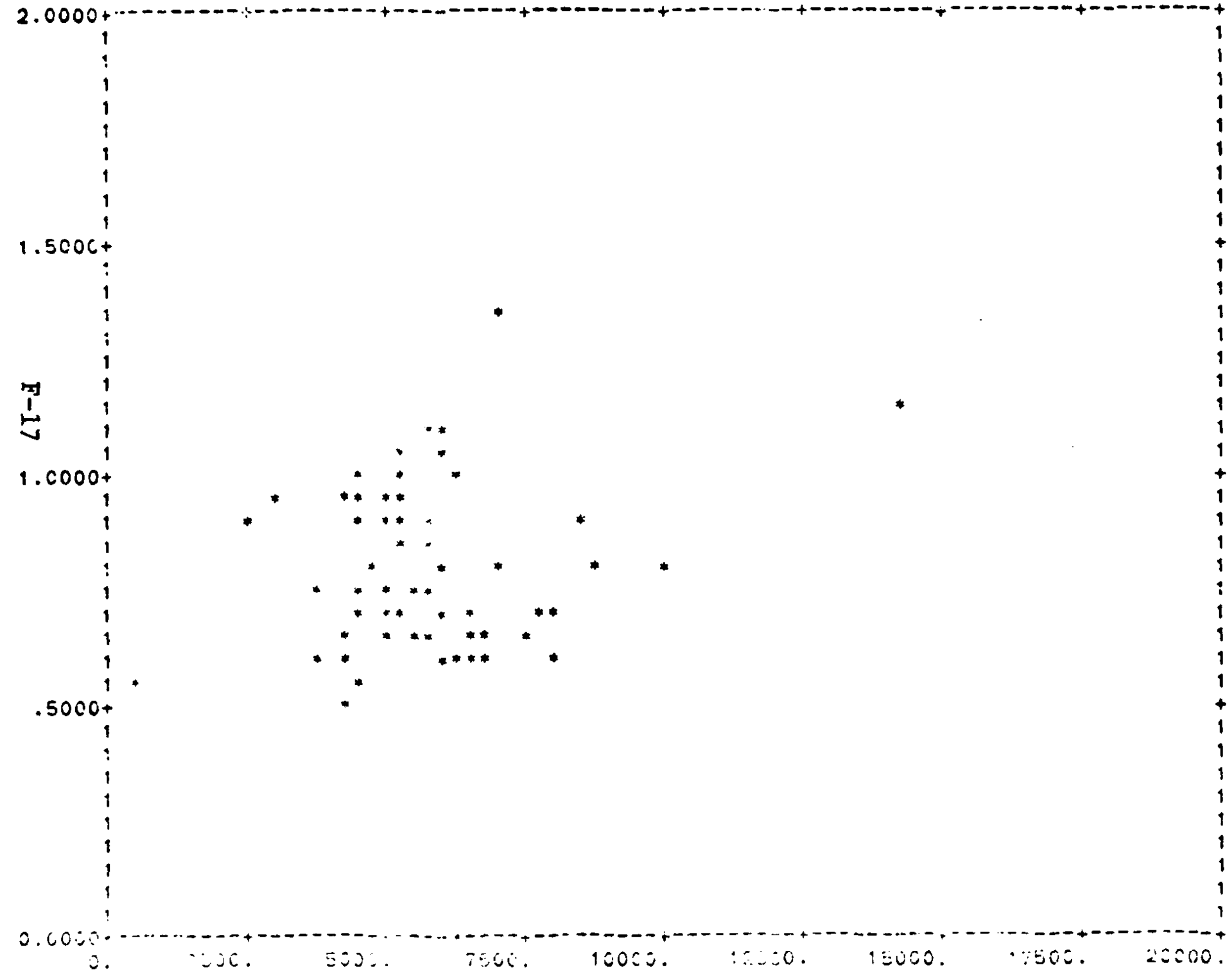
F-TEST= .181752312762
R**2= .0040226927704 CORRELATION EST= -.0634[illegible]70321215
S= .2631376330127
SLOPE EST= -5.5105712010448E-7 INTERCEPT EST= [illegible]394501

```
SYSTEM=O&S
     YVARIABLE=                    AVERAGE LENGTH OF SORTIES BY AIRCRAFT
     XVARIABLE=                    TOTAL FLYING HOURS
   VIETNAV   NO. OF OBS. =13
```



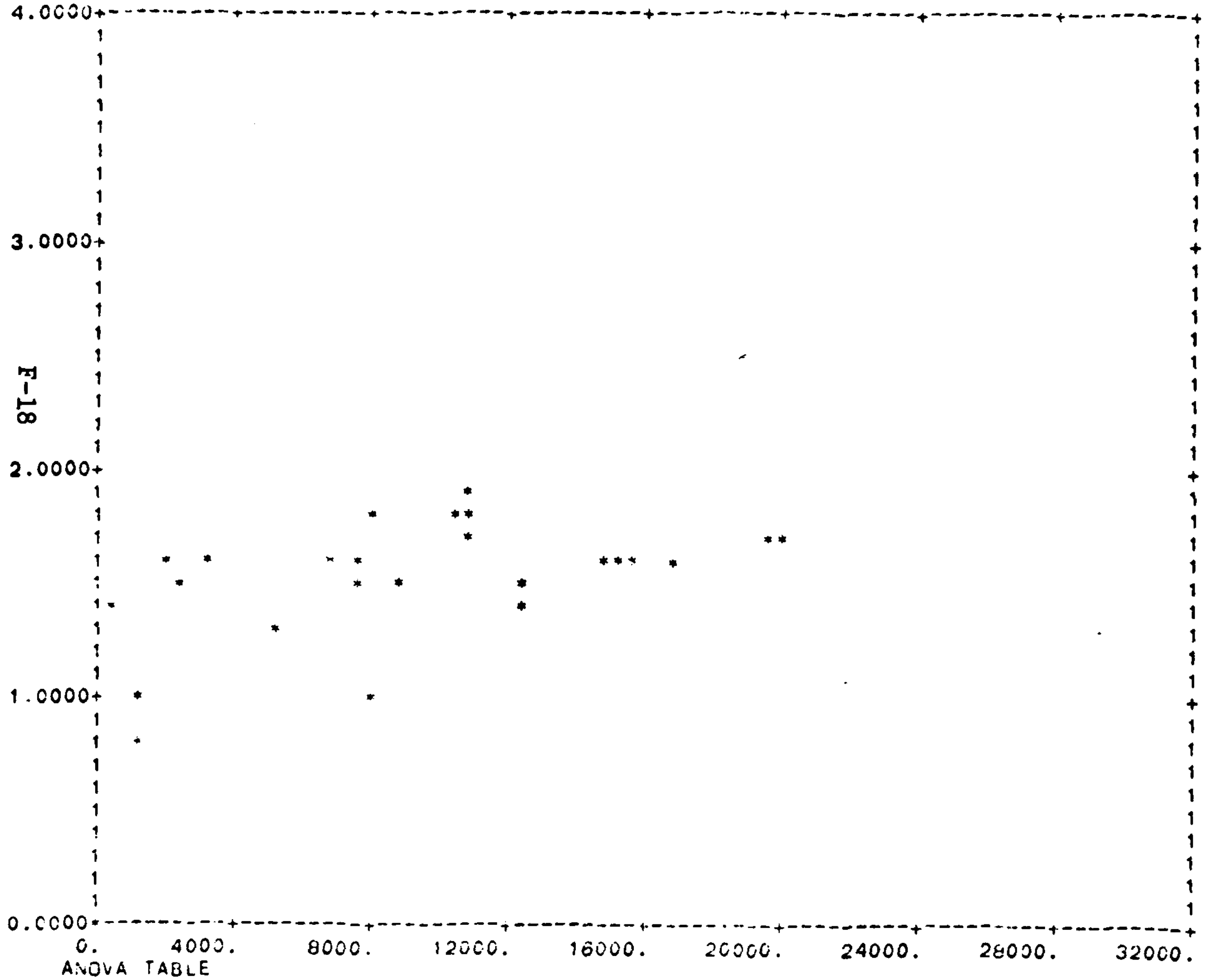

```
   ANOVA TABLE
REGRESSION    DF=   1.   SS=   .002243247356163   MS=   .002243247356163
RESIDUAL      DF=  11.   SS=   .1790119834131     MS=   .01627381667392
TOTAL         DF=  12.   SS=   .1812552307692
F-TEST=   .1378439613222
R**2=   1.237617996812      CORRELATION EST=   -.1112482807423
S=   .1275636703168
SLOPE EST=   -8.3832063529655E-7      INTERCEPT EST=   .4091833538379
```

SYSTEM=OV-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =64



ANOVA TABLE
REGRESSION DF= 1. SS= .00587676979958 MS= .00587676979958
RESIDUAL DF= 62. SS= 1.7[illegible]015464575 MS= .0[illegible]
TOTAL DF= 63. SS= 1.[illegible]92234375
F-TEST= 2.[illegible]
R**2= [illegible] CORRELATION EST= [illegible]20686
S= [illegible]
SLOPE EST= [illegible]7412327[illegible] INTERCEPT EST= [illegible]760203

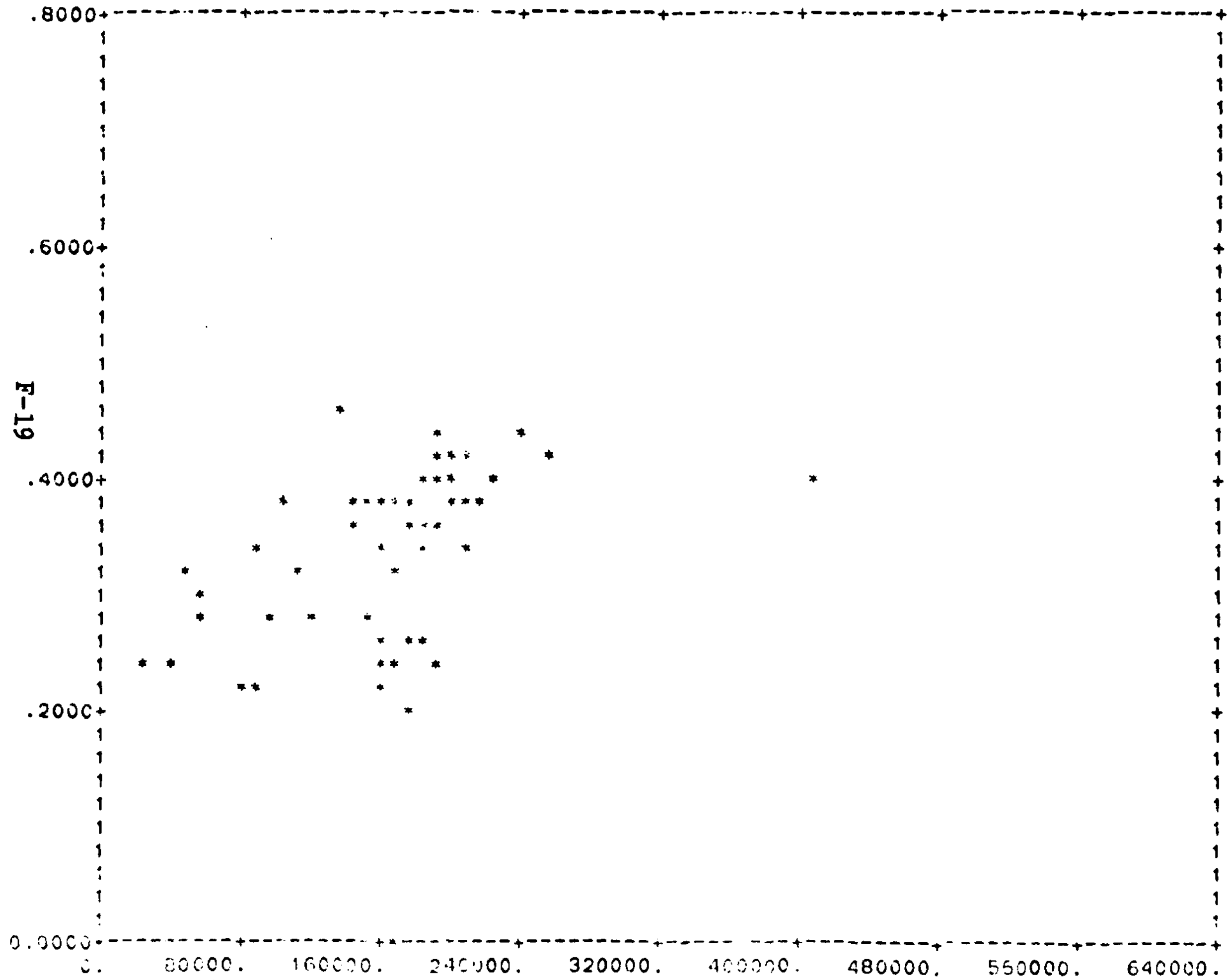
SYSTEM OV-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =28



ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  .8176599611137   MS=  .8176599611137
RESIDUAL     DF= 26.   SS= 1.881142753172     MS=  .07235164435277
TOTAL        DF= 27.   SS= 2.698802714286
F-TEST=   11.30119389031
R**2=   30.29713720034      CORRELATION EST=    .5504283531972
S=   .2689826C9759
SLOPE EST=   .00002935729642757      INTERCEPT EST=   1.2708877228
```

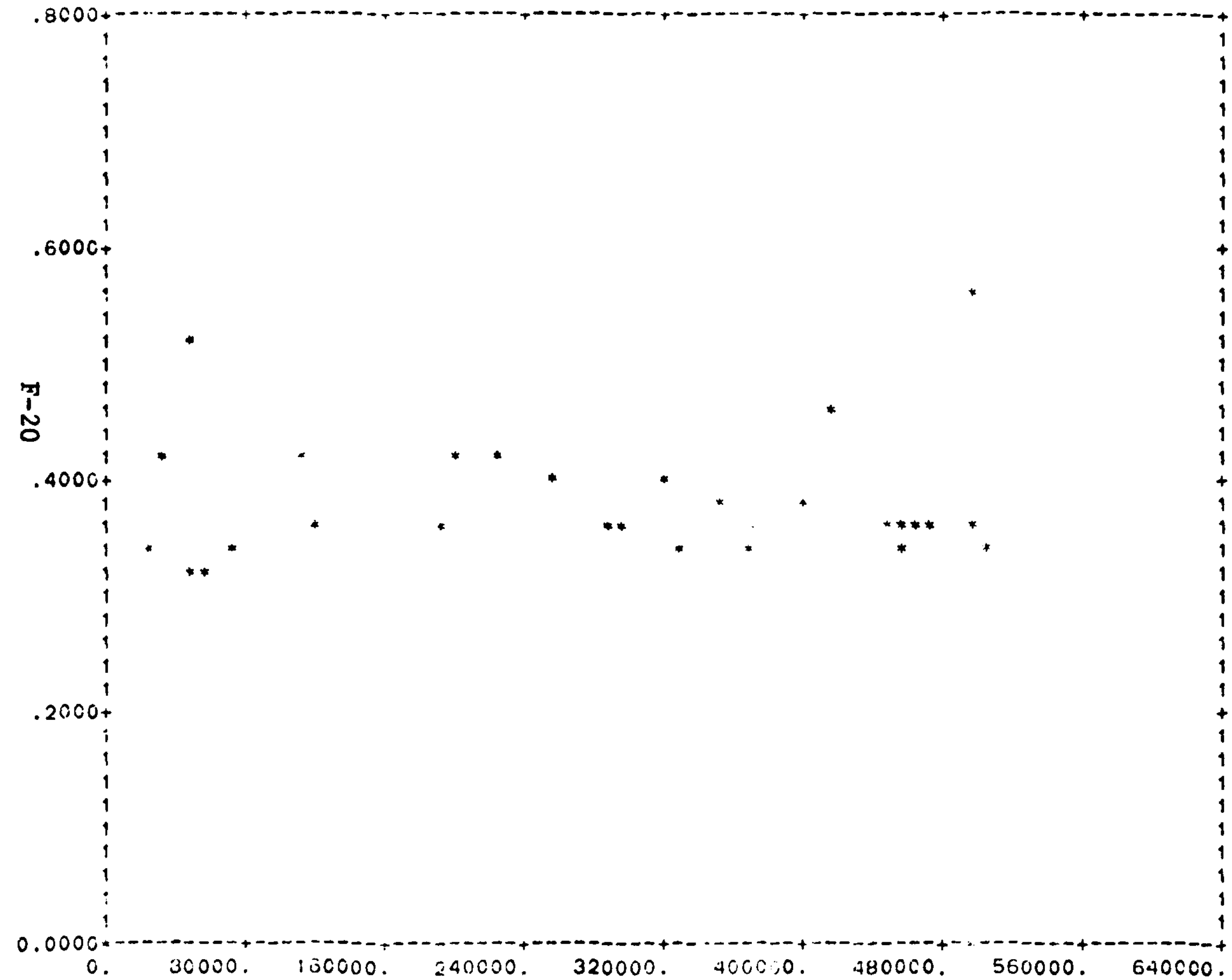
SYSTEM=UH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
WORLDWIDE NO. OF OBS. =64



ANOVA TABLE

```
REGRESSION   DF=  1.   SS=  .073183946512   MS=  .073183946512
RESIDUAL     DF=  62.  SS=  .214822037863   MS=  .003464871578435
TOTAL        DF=  63.  SS=  .288005984375
F-TEST=  21.1216[illegible]
R**2=  2[illegible]74        CORRELATION EST=  .5040[illegible]16
S=  .05[illegible]631.97[illegible]78
SLOPE EST=  5.705[illegible]1E-7      INTERCEPT EST=  .[illegible]2342014258
```

SYSTEM=UH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= TOTAL FLYING HOURS
VIETNAM NO. OF OBS. =29



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ANOVA TABLE
REGRESSION   DF=  1.   SS=  5.961631981299E-8   MS=  5.961631981299E-8
RESIDUAL     DF=  27.  SS=  .08835718176299     MS=  .003272488213444
TOTAL        DF=  28.  SS=  .08835724137931
F-TEST=  .00001821742842895
R**2=  .00006747191161963     CORRELATION EST=  .0008214128780317
S=  .05720566592082
SLOPE EST=  2.738373610879E-10     INTERCEPT EST=  .3804373389423
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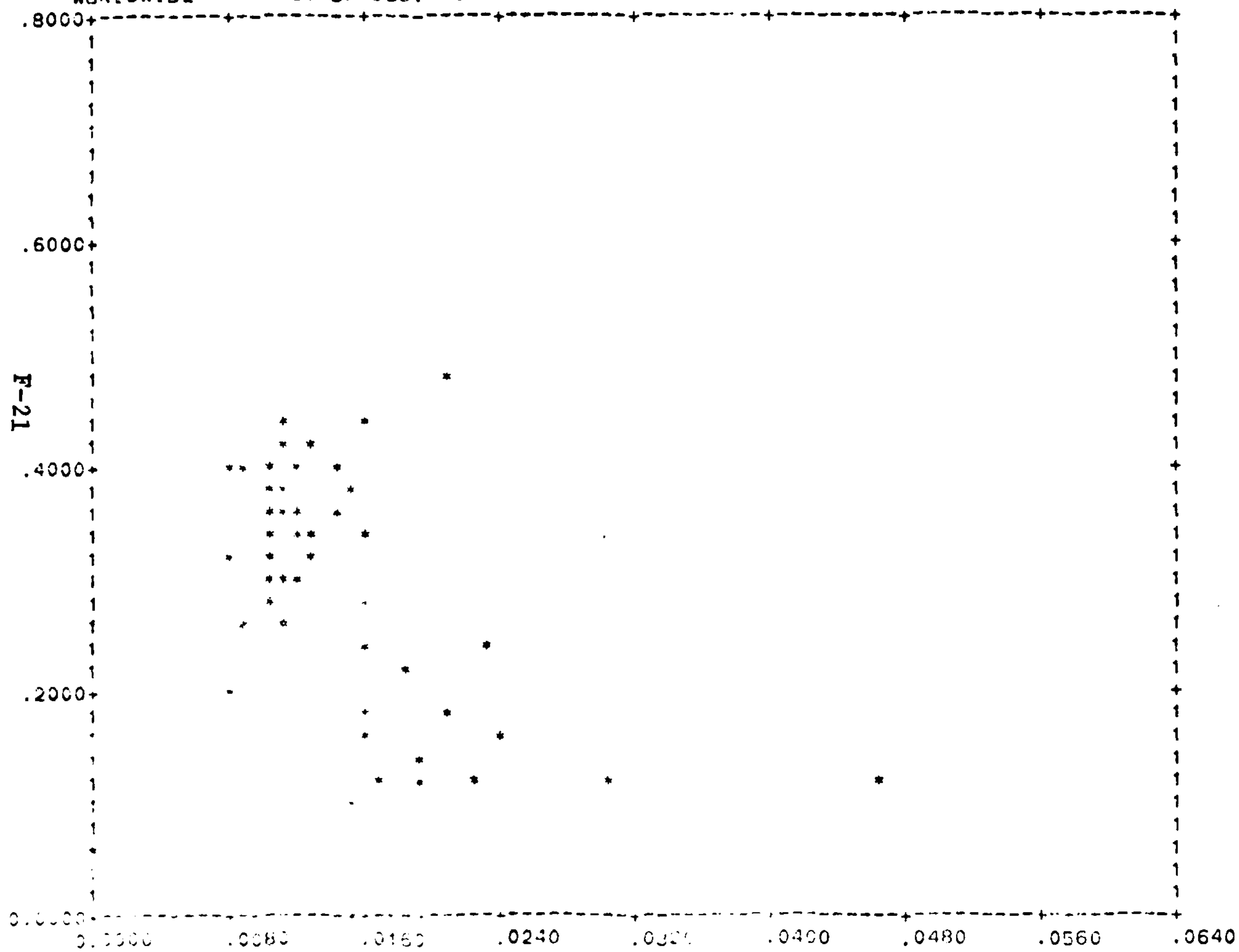
SYSTEM=AH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =54



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REGRESSION DF= 1. SS= [illegible]282675856 MS= [illegible]1768232675856
RESIDUAL DF= 52. SS= [illegible]96583403 MS= [illegible]00758[illegible]9533468
TOTAL DF= 53. SS= [illegible]470250259
F-TEST= [illegible]
R**2= [illegible] CORRELATION EST= -[illegible]780873
S= [illegible]
SLOPE EST= -9.13[illegible] INTERCEPT EST= [illegible]34144976

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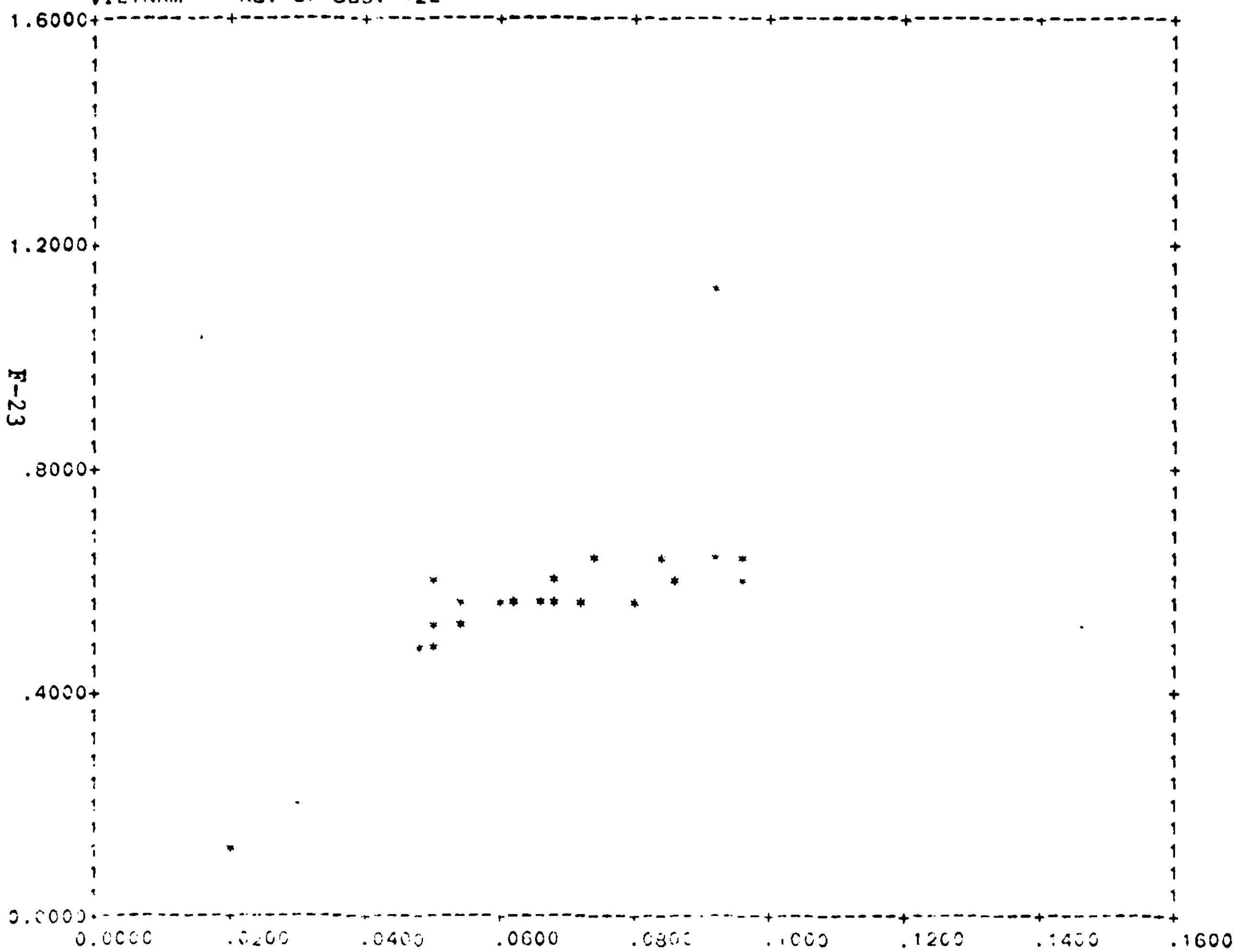
SYSTEM=AH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =22



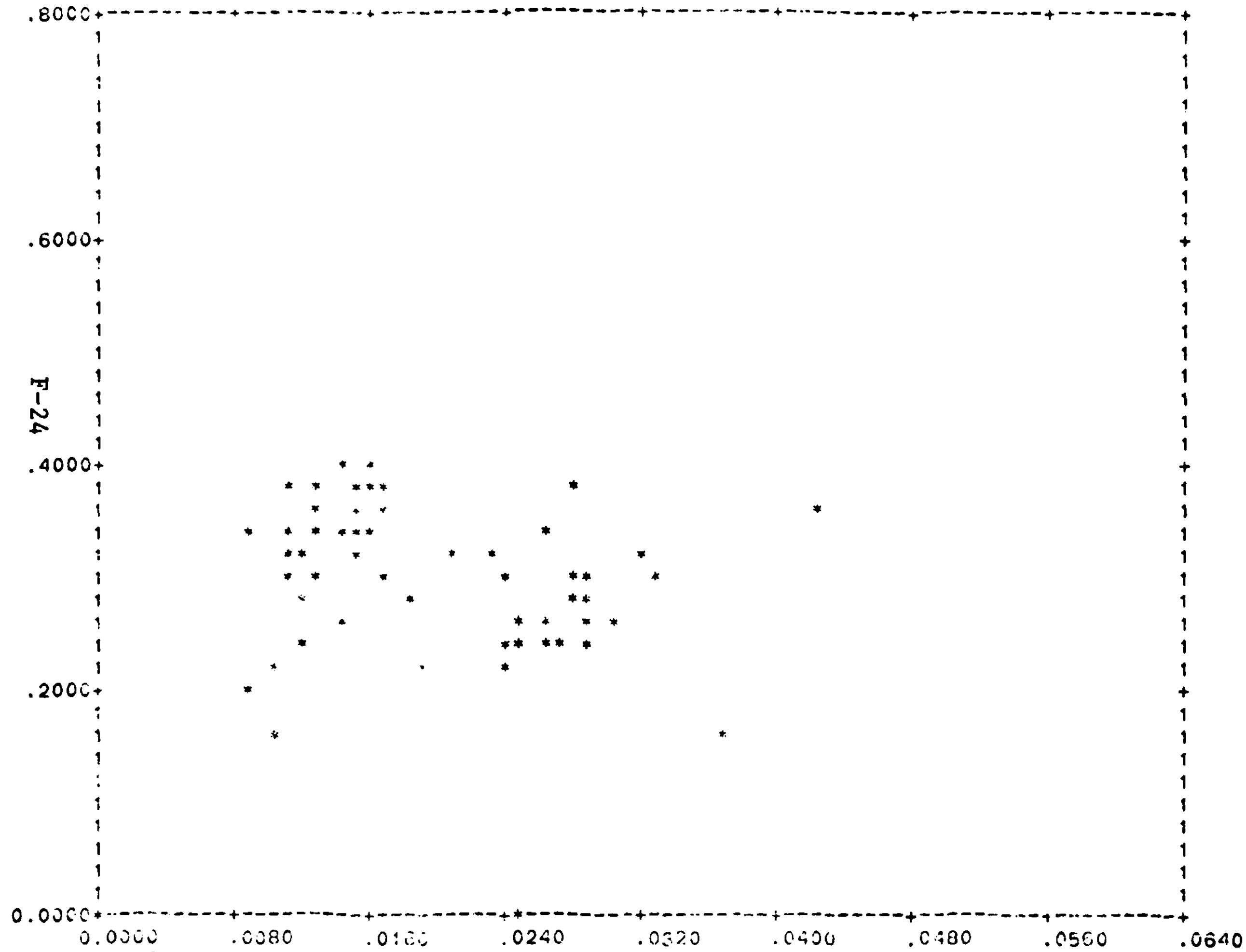
ANOVA TABLE

REGRESSION DF= 1. SS= .4111412785712 MS= .4111412785712
RESIDUAL DF= 20. SS= .3008260396106 MS= .01504130198053
TOTAL DF= 21. SS= .7119673181818

F-TEST= 27.3410402245
R**2= 57.74 ... CORRELATION EST= ... 5845
S= .122 ... 8533
SLOPE EST= ... 817 INTERCEPT EST= ... 2887058

F-23

SYSTEM [illegible]
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =64

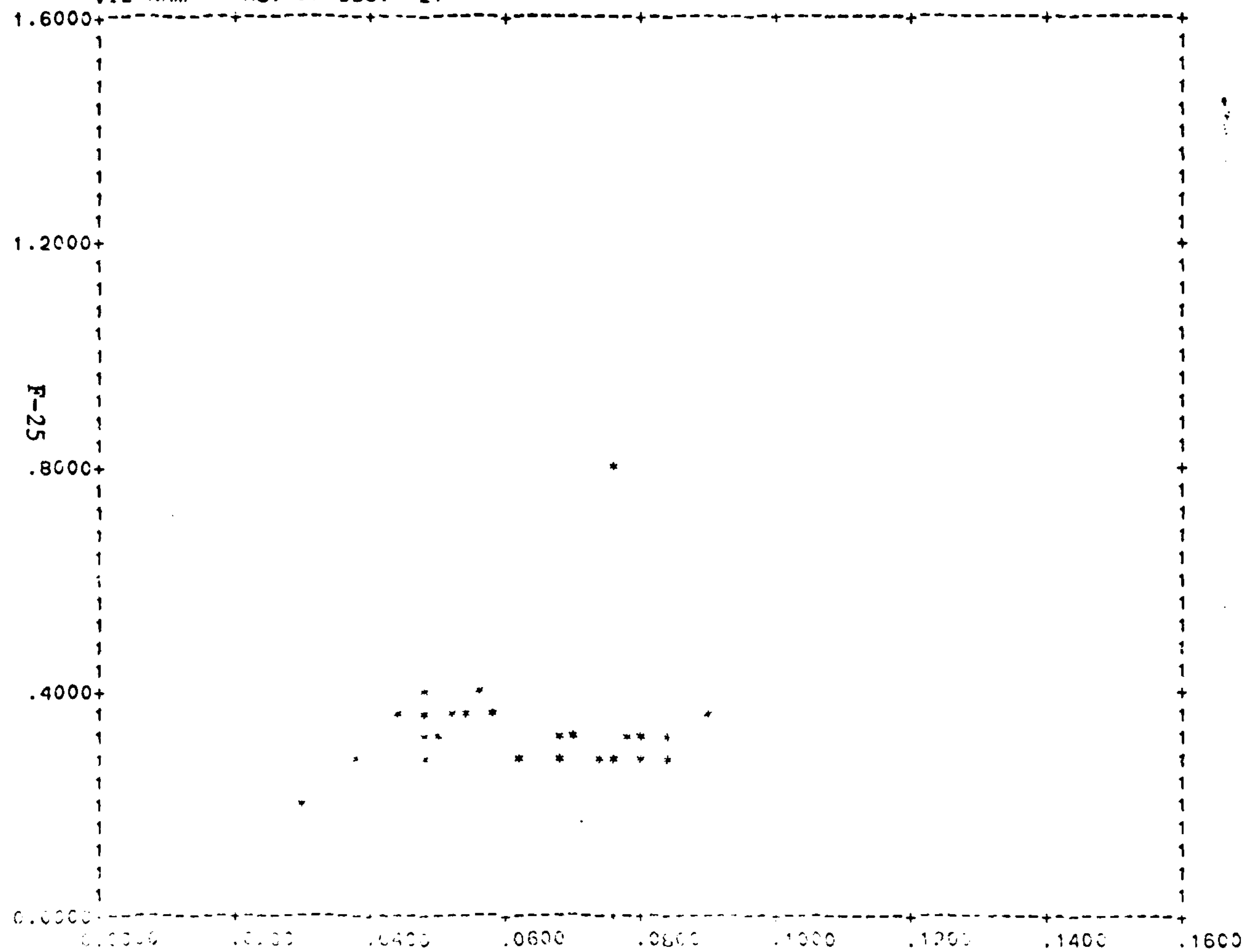


ANOVA TABLE

REGRESSION	DF=	1.	SS=	.01682951318404	MS=	.01682951318404
RESIDUAL	DF=	62.	SS=	.197868424316	MS=	.00319142619845
TOTAL	DF=	63.	SS=	.2146979375		

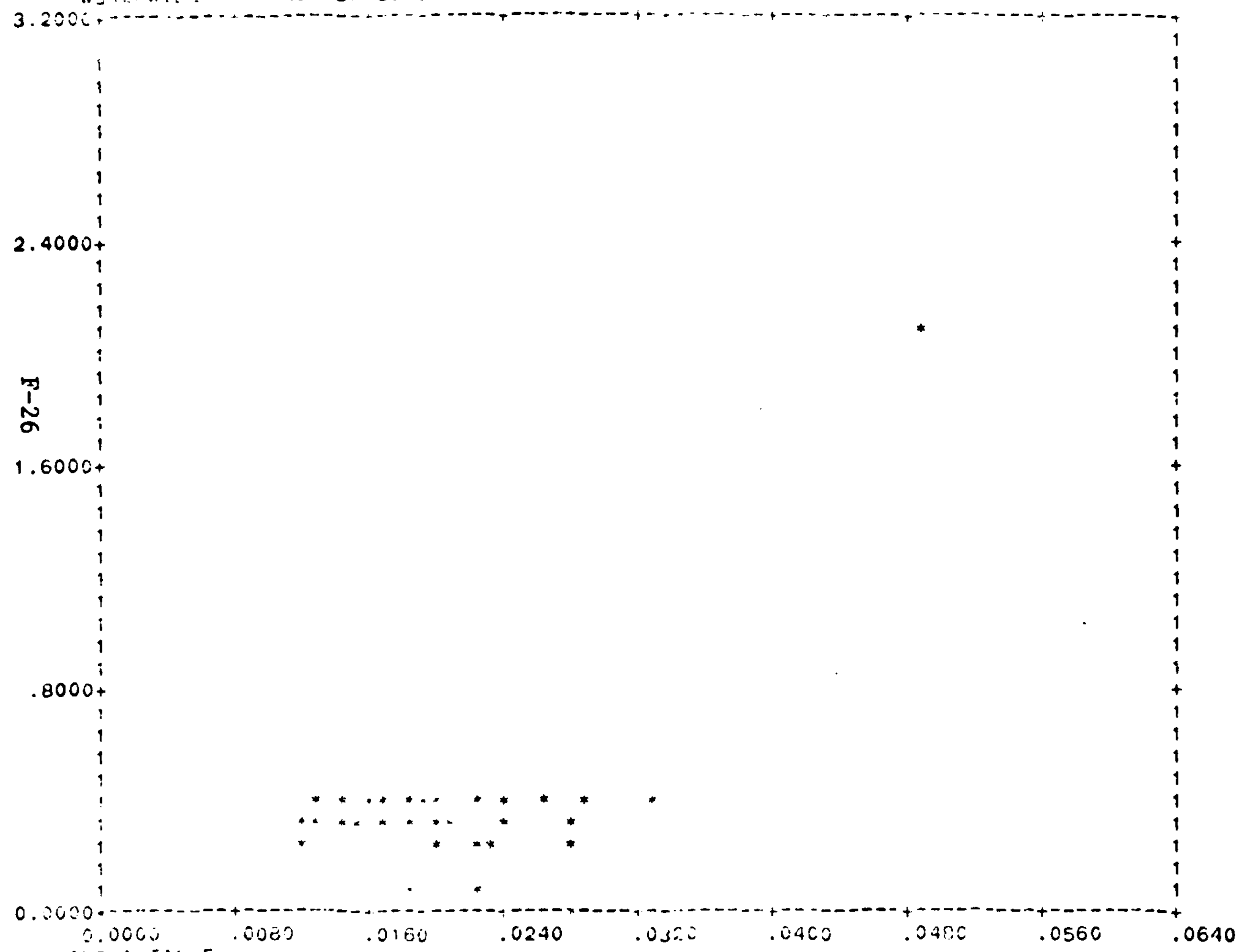
F-TEST= 5.273351829719
R**2= 7.838693459287 CORRELATION EST= -.2799708879437
S= .0564927925212
SLOPE EST= -2.111990885754 INTERCEPT EST= .3489021907807

SYSTEM=CH47
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =27



ANOVA TABLE
REGRESSION DF= 1. SS= .008903748697218 MS= .008903748697218
RESIDUAL DF= 25. SS= .2676243253769 MS= [illegible]
TOTAL DF= 26. SS= [illegible]
F-TEST= [illegible]
R**2= [illegible] CORRELATION EST= [illegible]
S= [illegible]
SLOPE EST= [illegible] INTERCEPT EST= [illegible]

SYSTEM [illegible]
YVARIABLE= AVERAGE [illegible] SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
[illegible] NO. OF OBS. 47



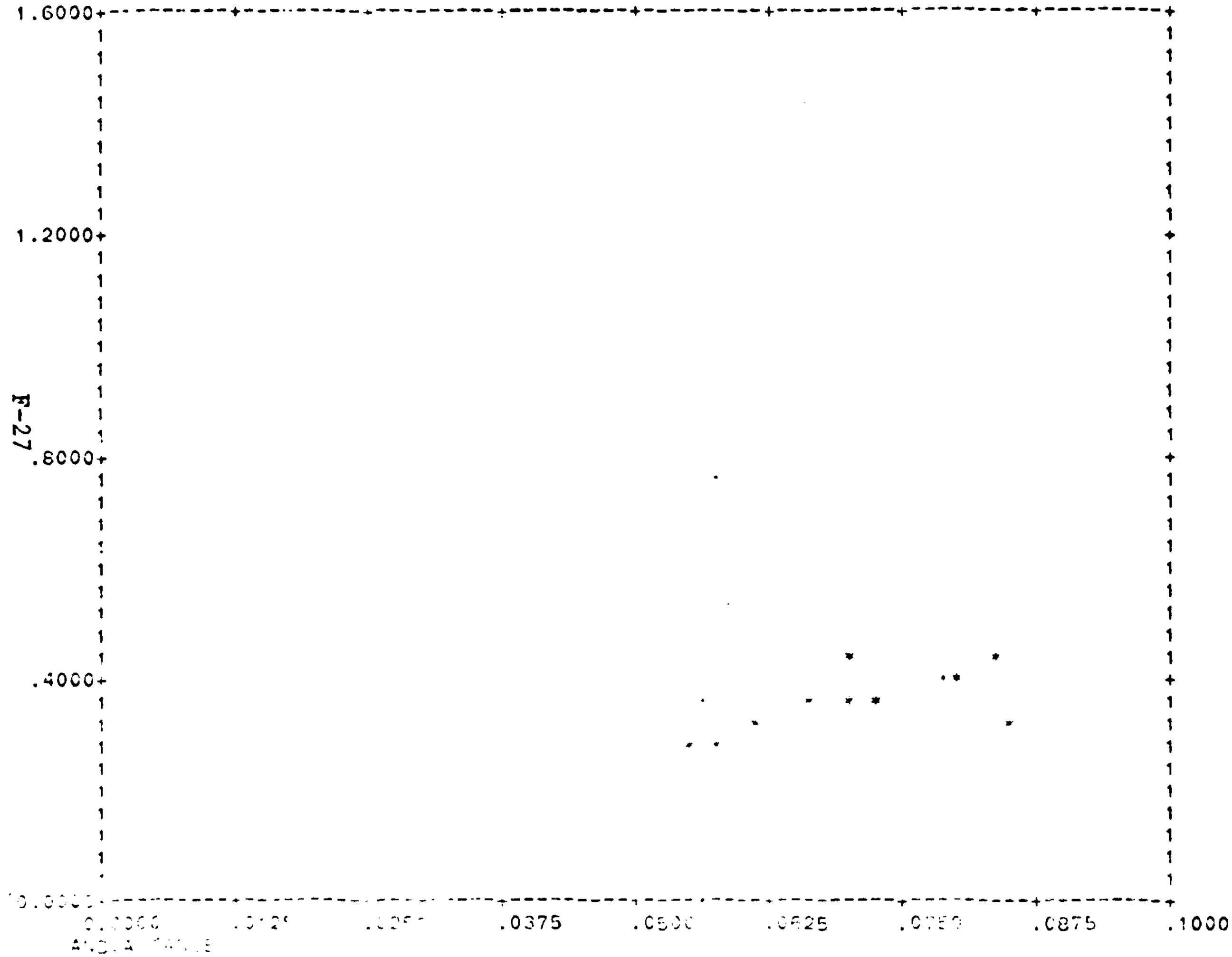
ANOVA TABLE

REGRESSION	DF=	1.	SS=	1.241058831645	MS=	1.241058831645
RESIDUAL	DF=	45.	SS=	1.887376147078	MS=	.0419416921573
TOTAL	DF=	46.	SS=	3.128434978723		

F-TEST= 29.59[illegible]20226
R**2= 39.67[illegible]1391 CORRELATION EST= .62[illegible]51295
S= .20[illegible]42
SLOPE EST= 25.4311453598 INTERCEPT EST= -.1271[illegible]1254019

F-26

SYSTEM=OH58
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =13



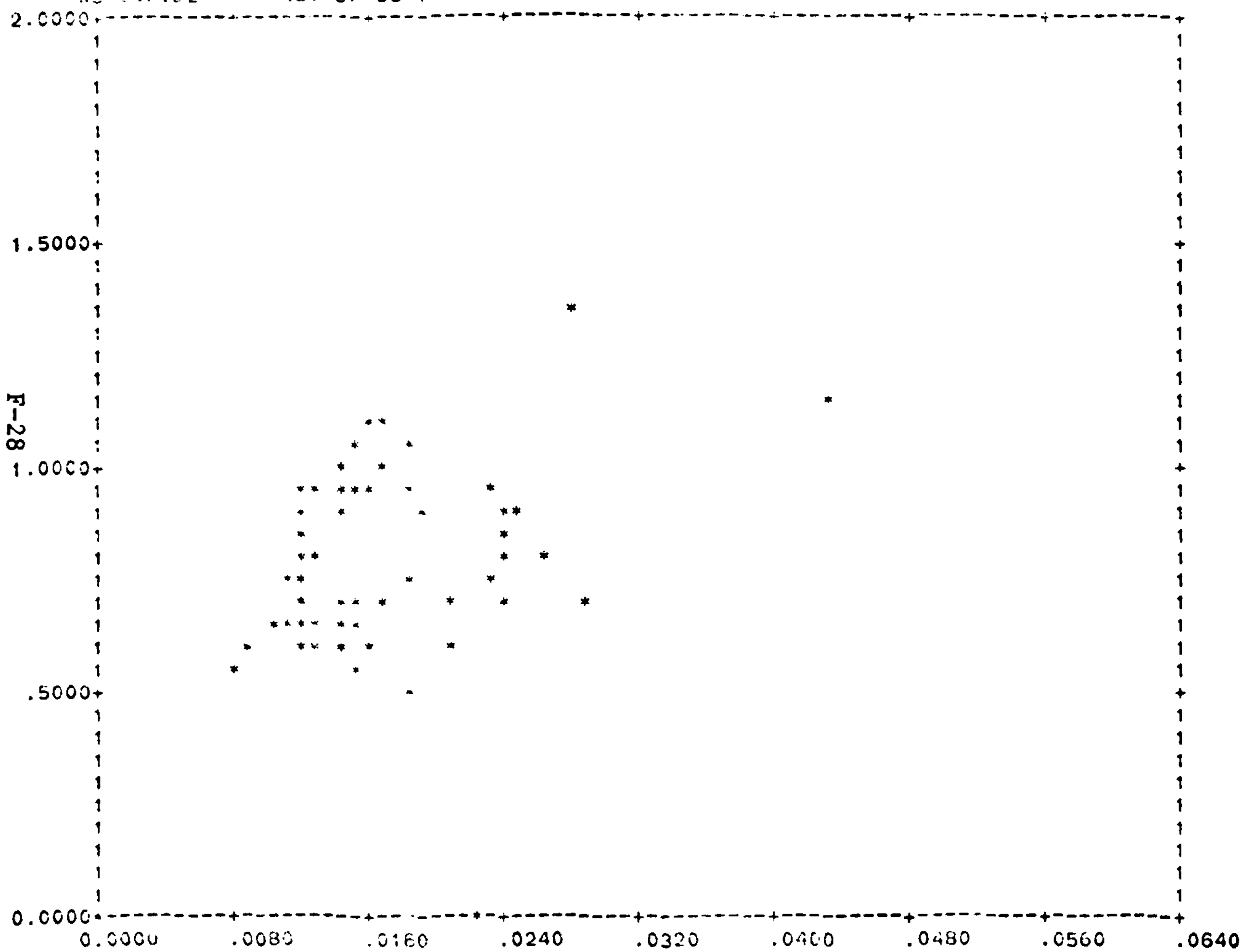
REGRESSION DF= 1. SS= .001543396101843 MS= .001543396101343
RESIDUAL DF= [illegible] SS= [illegible]118346674 MS= [illegible]743951522
TOTAL DF= [illegible] SS= [illegible]12552307692
F-TEST= [illegible]
[illegible] CORRELATION EST= [illegible]
S= [illegible]
SLOPE ES[illegible] [illegible] INTERCEPT EST= [illegible]87234181

SYSTEM CV-1

VARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT

VARIABLE= AVERAGE USAGE

HORIZONTAL NO. OF OBS. =64



ANOVA TABLE

REGRESSION	DF= 1.	SS= .23377282141	MS= .23377282141
RESIDUAL	DF= 62.	SS= 1.597119412965	MS= .02575999053169
TOTAL	DF= 63.	SS= 1.830892234375	

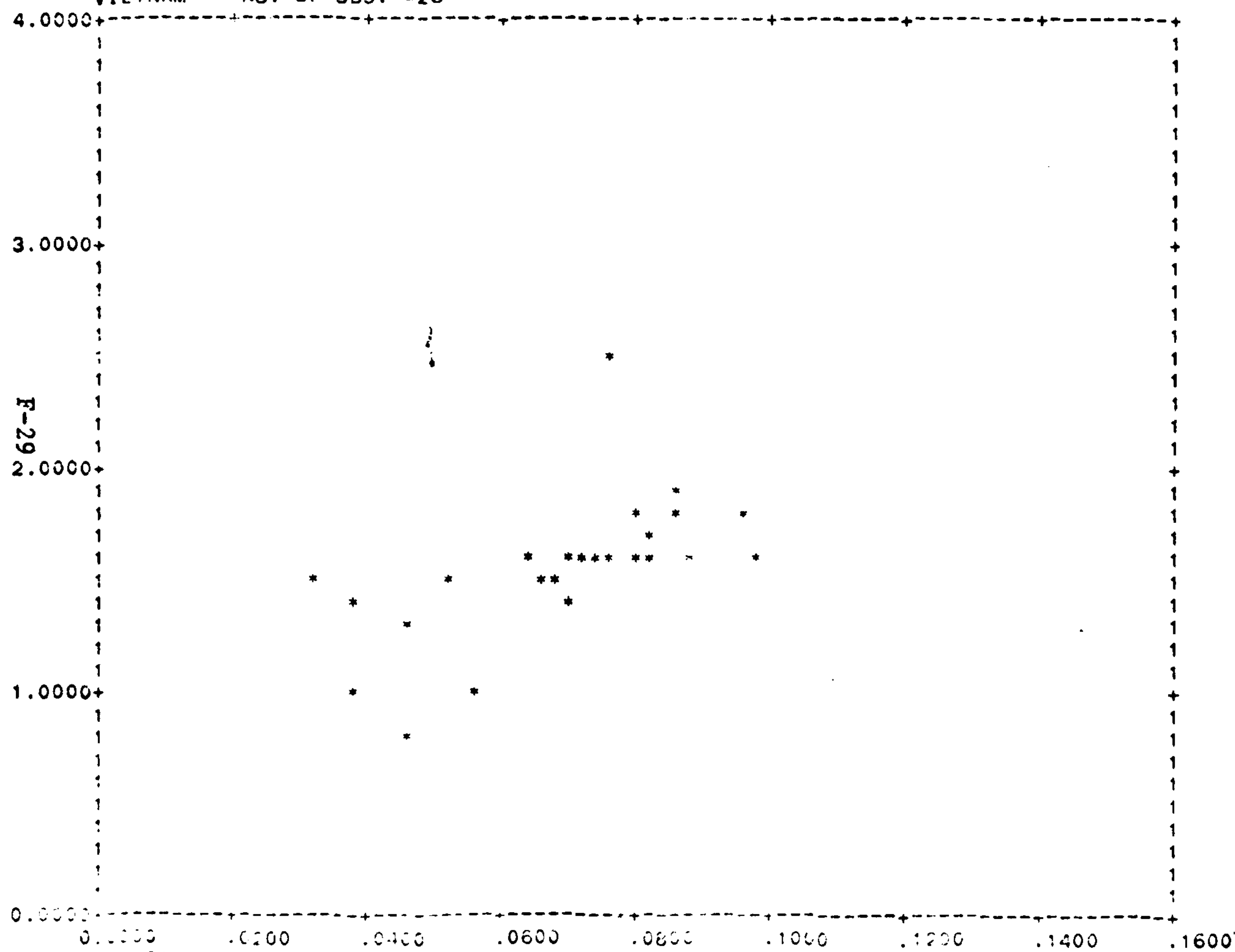
F-TEST= 9.07503522[illegible]39

R**2= 12.76824583235 CORRELATION EST= .3573268228433

S= .1604091916855

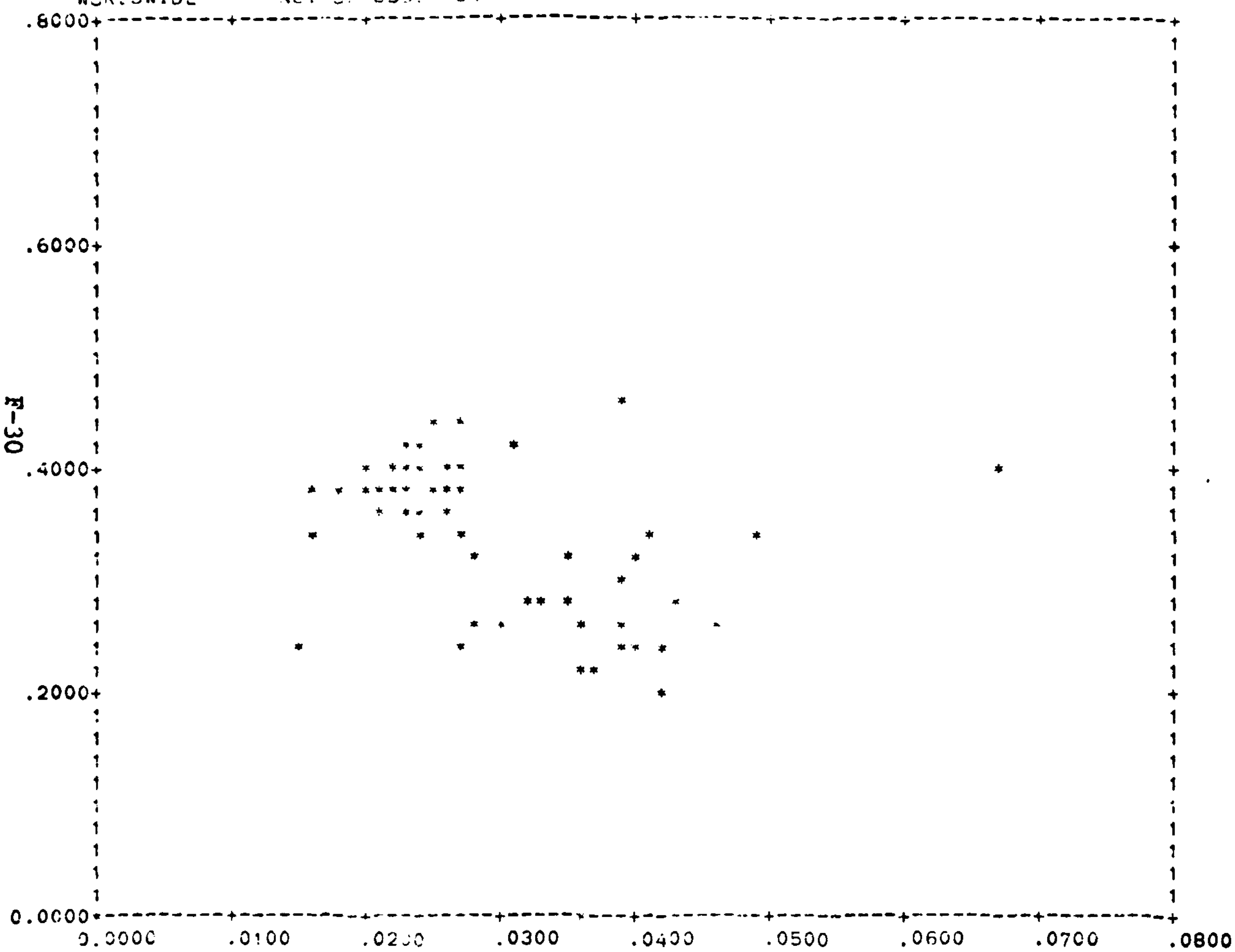
SLOPE EST= 10.11154087964 INTERCEPT EST= .62[illegible]90222234

SYSTEM=OV-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =26



ANOVA TABLE
REGRESSION DF= 1. SS= 1.0152[illegible]5256432 MS= 1.015215256432
RESIDUAL DF= 2[illegible]. SS= [illegible]87437854 MS= [illegible]363763[illegible]
TOTAL DF= 27. SS= [illegible]02714286
F-TEST= [illegible]
R**2= [illegible] CORRELATION EST= .61[illegible]771
S= .2[illegible]
SLOPE EST= 11.34[illegible]39487 INTERCEPT EST= .7[illegible]3419053

SYSTEM-[illegible]-1
[illegible]ABLE= AVERAGE [illegible] OF SO[illegible]IES BY AIRCRAFT
[illegible]VARIABLE= AVERAGE USAGE
WORLDWIDE NO. OF OBS. =64

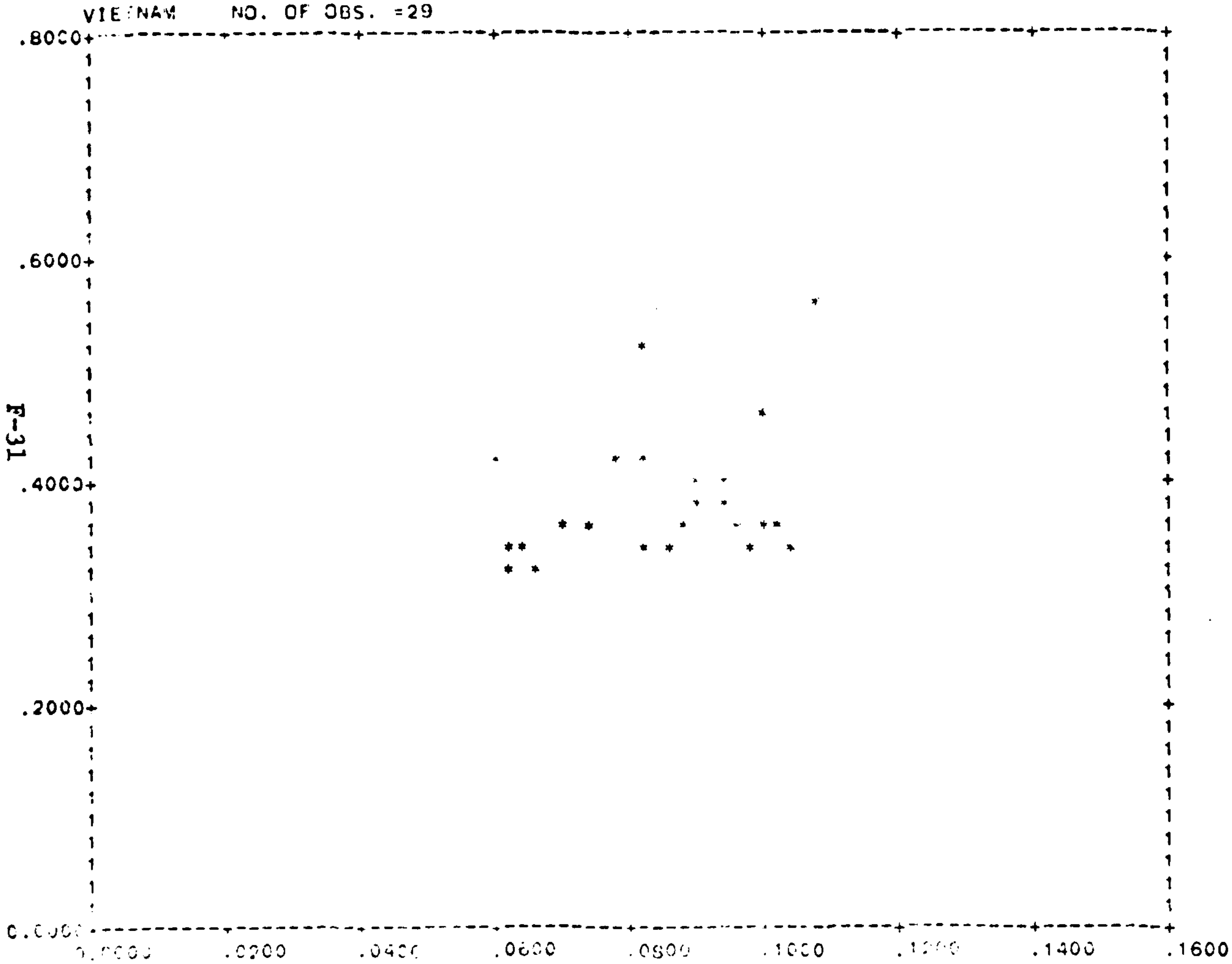


ANOVA TABLE

REGRESSION	DF= 1.	SS= .05096871192717	MS= .05096871192717	
RESIDUAL	DF= 62.	SS= .2370372724478	MS= .003823181813675	
TOTAL	DF= 63.	SS= .288005984375		

F-TEST= 13.33149047342
R**2= 17.69710169967 CORRELATION EST= -.4206792327851
S= .06183188347134
SLOPE EST= -2.852857812052 INTERCEPT EST= .425[illegible]30106089

SYSTEM=UH-1
YVARIABLE= AVERAGE LENGTH OF SORTIES BY AIRCRAFT
XVARIABLE= AVERAGE USAGE
VIETNAM NO. OF OBS. =29

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ANOVA TABLE
REGRESSION   DF=  1.   SS=  .0[illegible]75996629   MS=  .00508475996629
RESIDUAL     DF= 27.   SS=  [illegible]248141302    MS=  [illegible]416597[illegible]
TOTAL        DF= 28.   SS=  .0[illegible]724137931
F-TEST=  [illegible]23073
R**2=  [illegible]  CORRELATION EST=  .23[illegible]
S=  .05[illegible]
SLOPE EST=  .9[illegible]192227   INTERCEPT EST=  [illegible]
```

APPENDIX G

SAMPLE DATA COLLECTION - BRIGHT STAR EXERCISE

UH-60 - BLACKHAWK

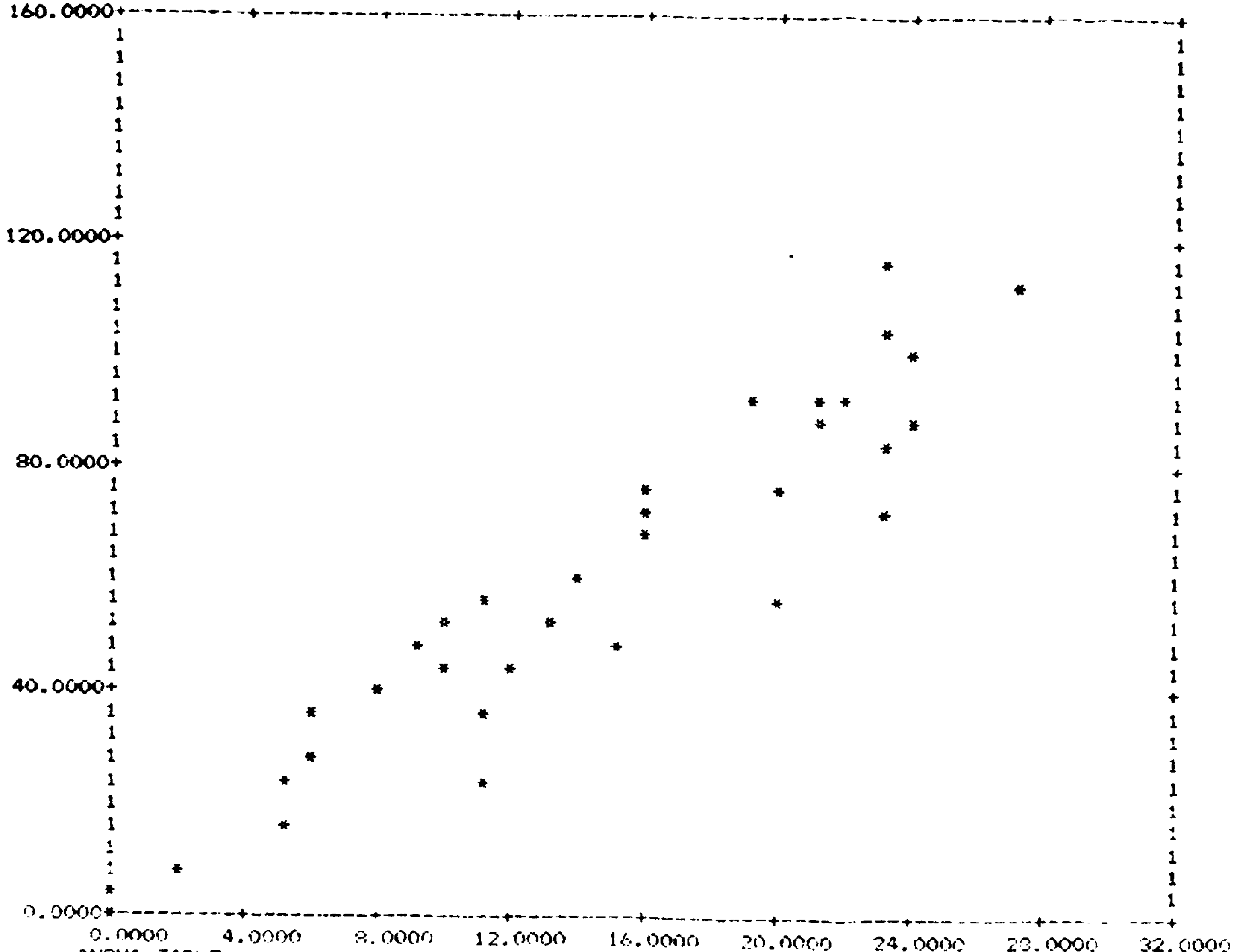
REGRESSION ANALYSIS

Y VARIABLE (DEPENDENT)	X VARIABLE (INDEPENDENT)
TOTAL SORTIES	TOTAL FLYING HOURS
MAINTENANCE EVENTS PER FLYING HOUR	SORTIE LENGTH
MAINTENANCE EVENTS	FLYING HOURS
MAINTENANCE SORTIES	SORTIES
MAINTENANCE MANHOURS	SORTIE LENGTH
MAINTENANCE MANHOURS	FLYING HOURS

SYSTEM= UH-60, BLACKHAWK

SAMPLE DATA COLLECTION DATA BRIGHT STAR-EXERCISE

SORTIES VS. FLYING HOURS



ANOVA TABLE

REGRESSION	DF=	1.	SS=	22984.33251525	MS=	22984.33251525
RESIDUAL	DF=	33.	SS=	[illegible]	MS=	[illegible]
TOTAL	DF=	34.	SS=	[illegible]		

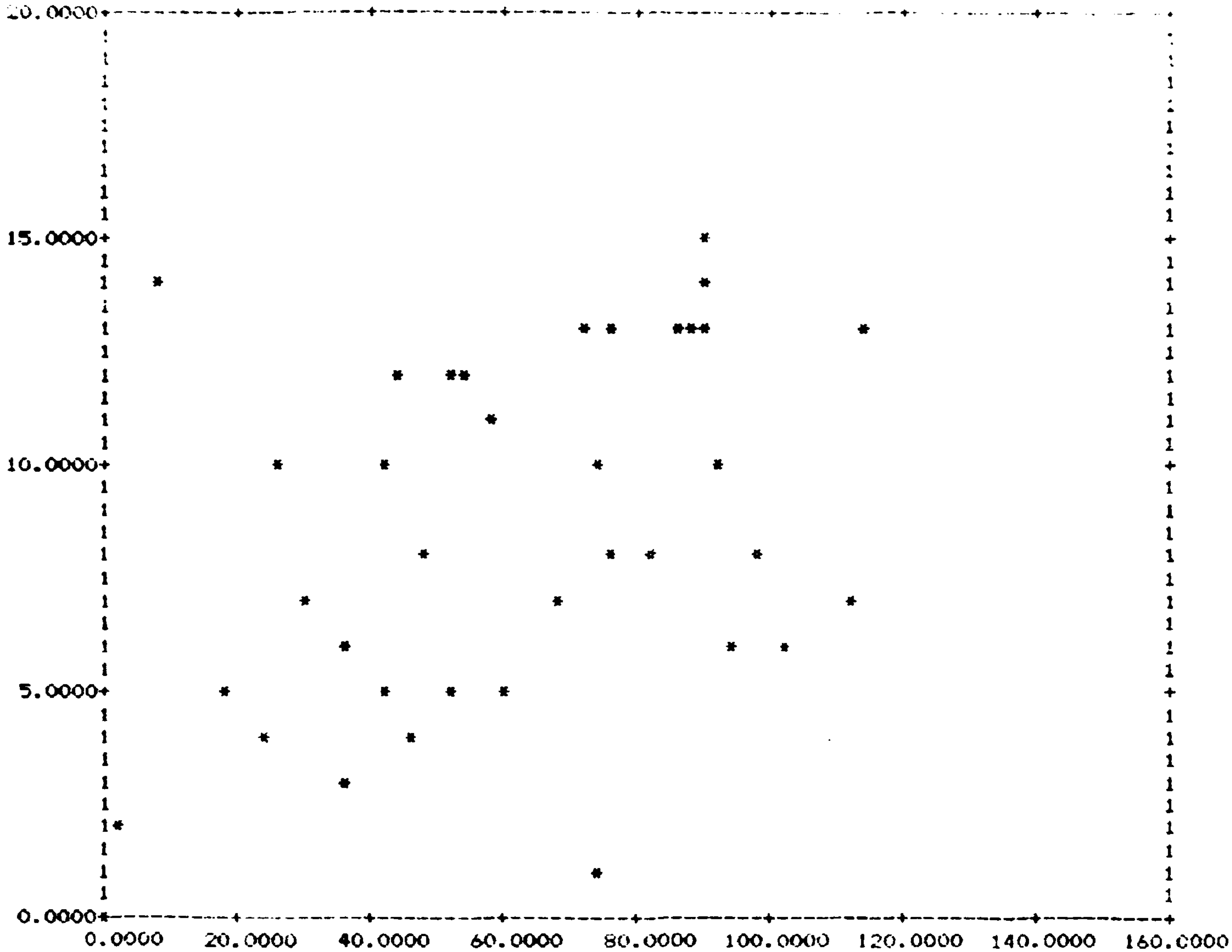
F TEST= [illegible]

R**2= [illegible] STAR ERR= [illegible]

[illegible] GOOD FIT= [illegible]

SYSTEM= UH-60.BLACKHAWK   SAMPLE DATA COLLECTION DATA BRIGHT STAR EXERCISE

MAINTENANCE EVENTS VS. SORTIES



ANOVA TABLE

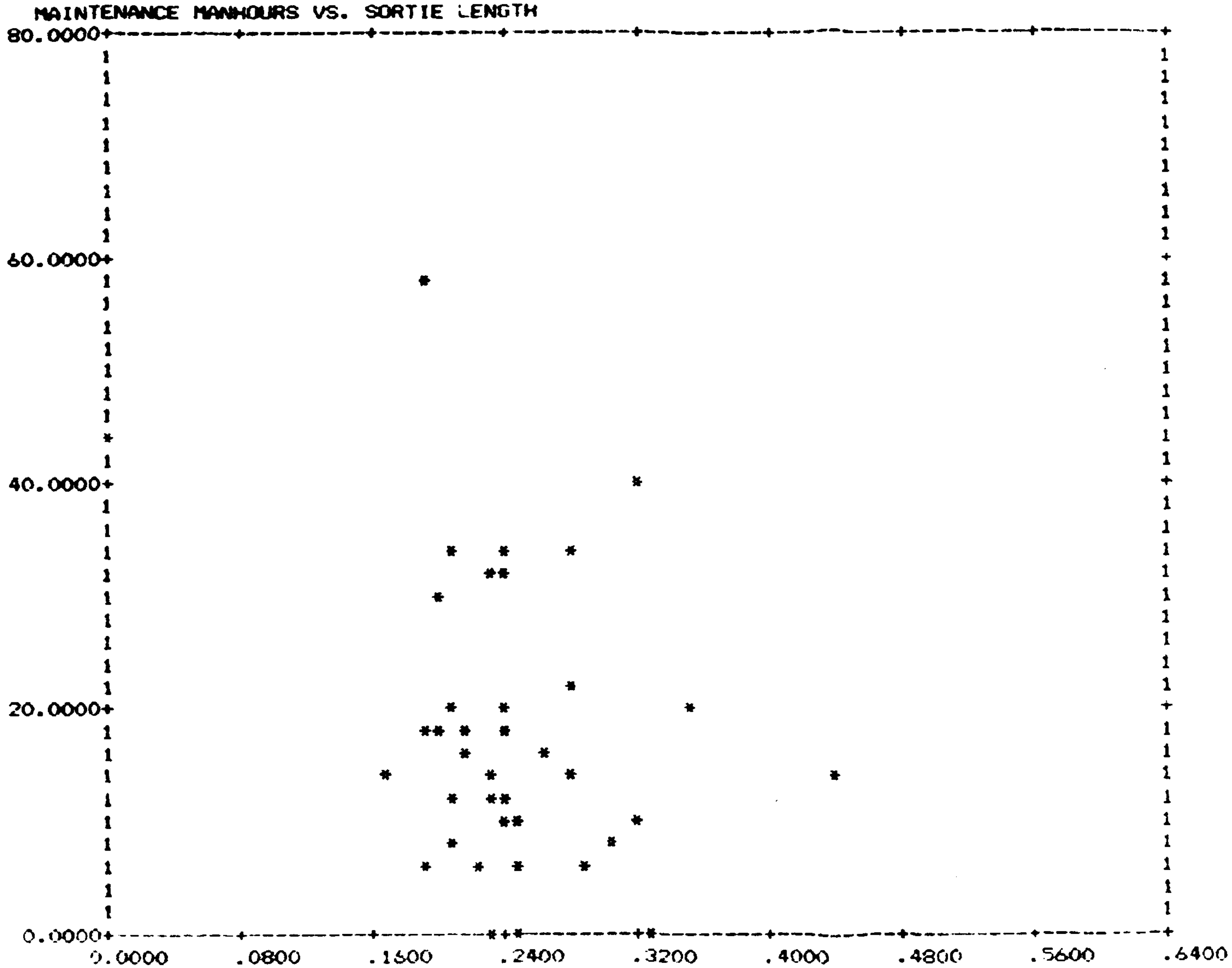
REGRESSION	DF=	1.	SS=	57.46078198121	MS=	57.46078198121
RESIDUAL	DF=	34.	SS=	462.1781069077	MS=	13.59347373258
TOTAL	DF=	35.	SS=	519.6388888889		

F-TEST= 4.227085961368

R**2= 11.05782942922 CORR EST= .3325331476593

B(1) EST= .04349336959534 B(0) EST= 5.989398485446

SYSTEM= UH-60.BLACKHAWK SAMPLE DATA COLLECTION DATA BRIGHT STAR-EXERCISE



ANOVA TABLE

REGRESSION	DF=	1.	SS=	44.24535155002	MS=	44.24535155002
RESIDUAL	DF=	33.	SS=	4960.883505593	MS=	150.3301062301
TOTAL	DF=	34.	SS=	5005.128857143		

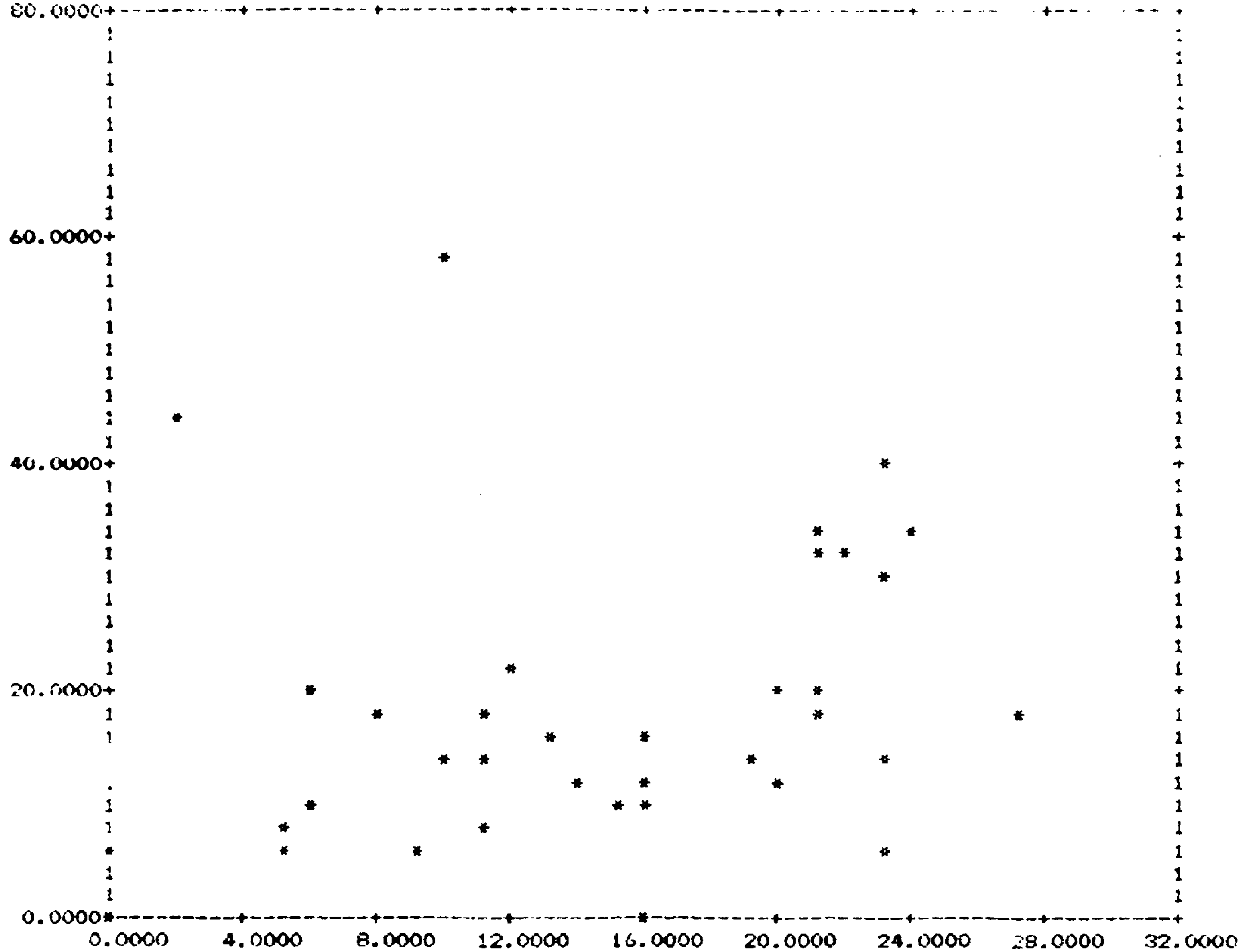
F-TEST= .2943212950459

R**2= .0088398426171 CORR EST= -.09402112349472

R(1) EST= -21.44035189063 R(0) EST= 23.45167920099

SYSTEM= UH-60, BLACKHAWK SAMPLE DATA COLLECTION DATA BRIGHT STAR-EXERCISE

MAINTENANCE MANHOURS VS. FLYING HOURS



ANOVA TABLE

REGRESSION	DF= 1.	SS= 154.5415153271	MS=	154.5415153271
RESIDUAL	DF= 33.	SS= 5342.501341816	MS=	161.893980055
TOTAL	DF= 34.	SS= 5497.042857143		

F-TEST= .9545846934801

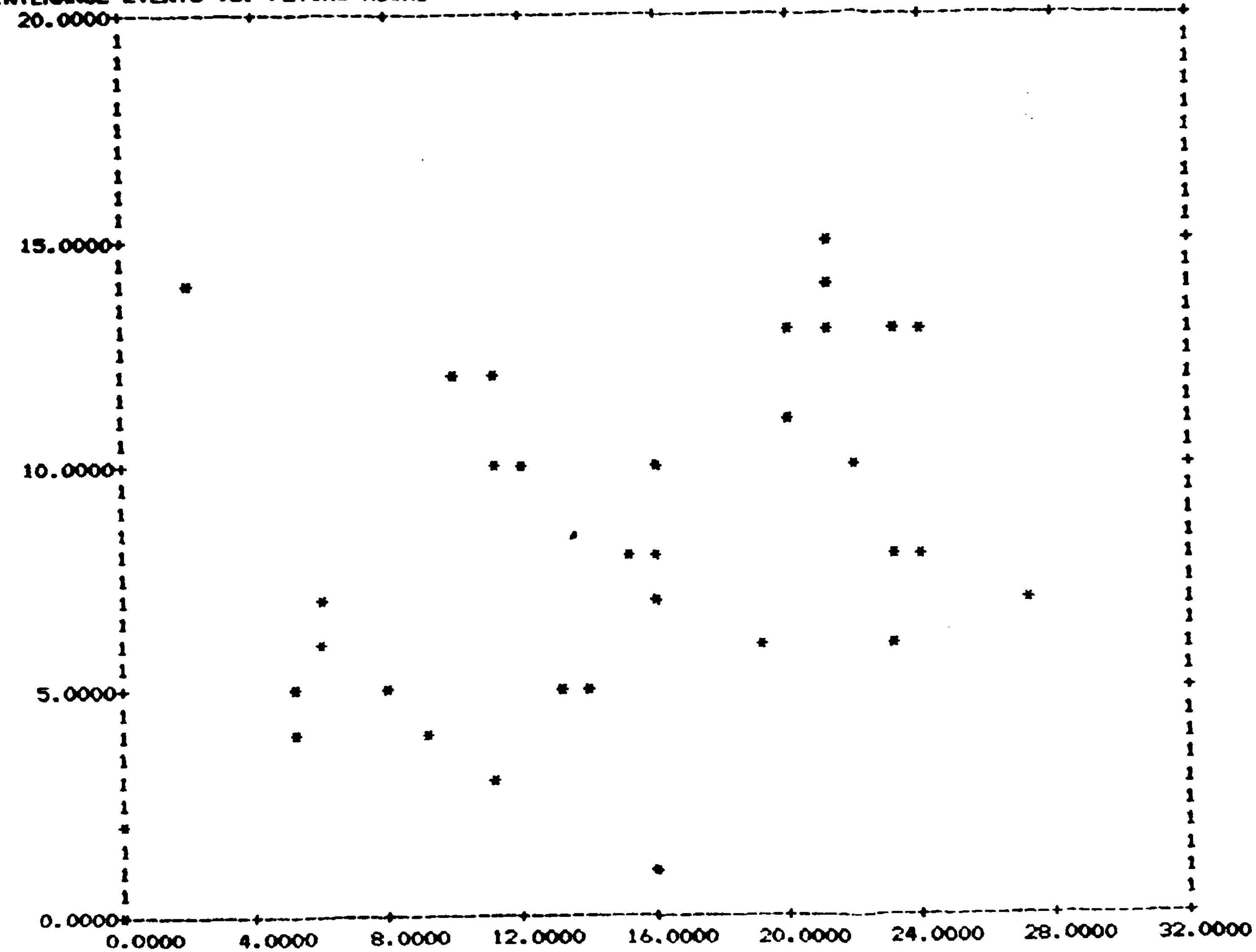
R**2= 2.811357294155 CORR EST= .1676710259453

B(1) EST= .31650738971 B(0) EST= 14.36628514279

SYSTEM= UH-60.BLACKHAWK

SAMPLE DATA COLLECTION DATA BRIGHT STAR-EXERCISE

MAINTENANCE EVENTS VS. FLYING HOURS



ANOVA TABLE

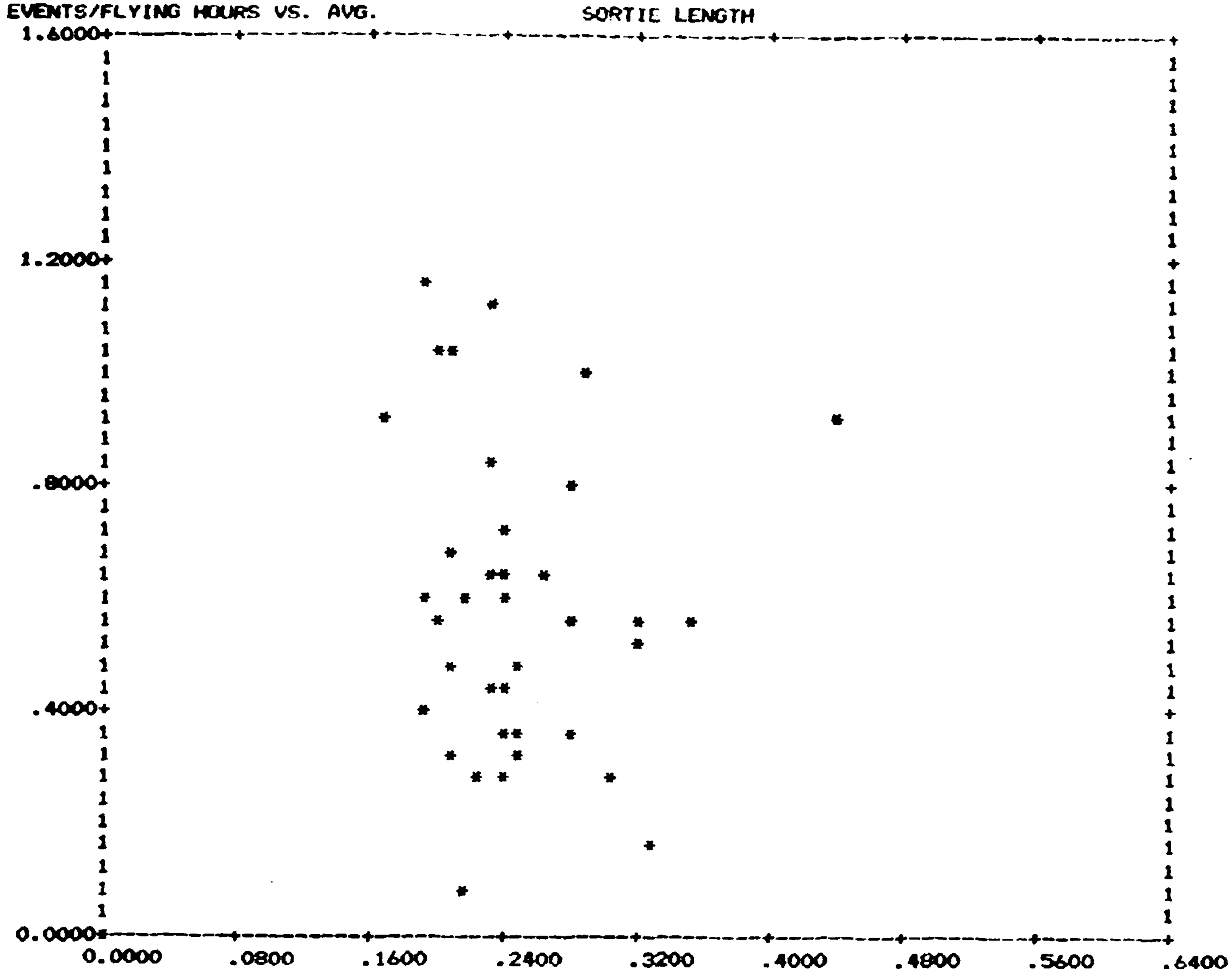
REGRESSION	DF=	1.	SS=	51.24658348282	MS=	51.24658348282
RESIDUAL	DF=	33.	SS=	422.29627366	MS=	12.79685677758
TOTAL	DF=	34.	SS=	473.5428571429		

F-TEST= 4.004622726779

R**2= 10.82195258778 CORR EST= .3289673629371

B(1) EST= .1822609919621 B(0) EST= 6.052857724932

SYSTEM= UH-60.BLACKHAWK SAMPLE DATA COLLECTION DATA BRIGHT STAR-EXERCISE



ANOVA TABLE

REGRESSION	DF=	1.	SS=	.02105849842372	MS=	.02105849842372
RESIDUAL	DF=	35.	SS=	2.721530690765	MS=	.07775801973616
TOTAL	DF=	36.	SS=	2.742589189189		

F-TEST= .2708209197608

R**2= .7678327657212 CORR EST= -.08762606722438

B(1) EST= -.4524370360757 B(0) EST= .6930750822434

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